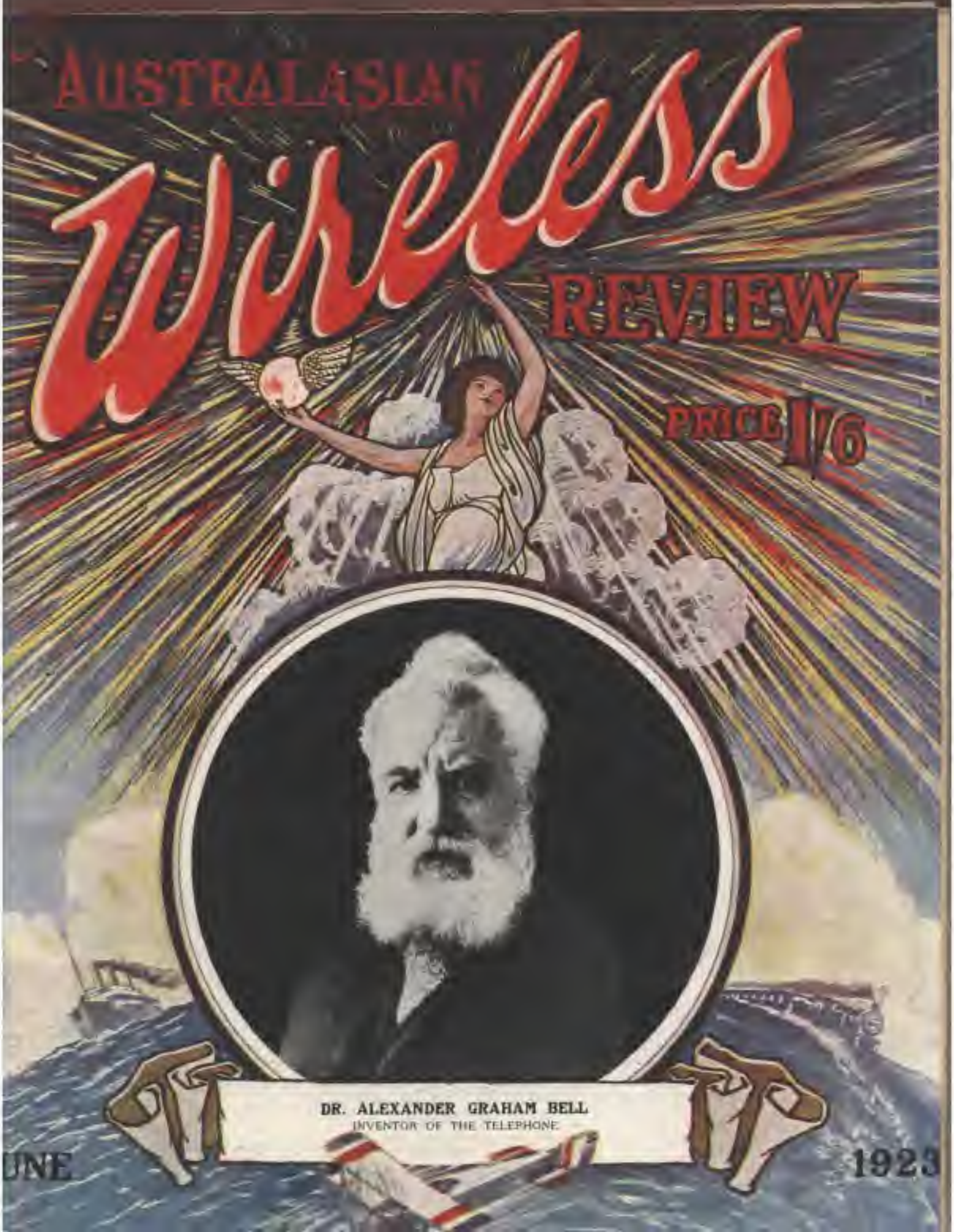

AUSTRALASIAN
Wireless
REVIEW
PRICE 1/6
DR. ALEXANDER GRAHAM BELL
INVENTOR OF THE TELEPHONE
UNE
1923

The

AUSTRALASIAN WIRELESS REVIEW

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To the Publishers of "THE AUSTRALASIAN WIRELESS REVIEW," 304 Kent Street, Sydney, N.S.W., Australia

Editorial

NO RESPONSE

ON April 27th, we forwarded a registered letter to Amalgamated Wireless (Australia), Ltd., at 97 Clarence Street, Sydney, renewing our offer to insert, free of all charge, full particulars of any patent or patents they claimed to hold pertaining to radio transmitters and receivers, and our letter informed them that their reply would be inserted in this, the June number of the "Review," if it reached this office by May 12th. That date has come and gone, and there has been no response to our letter.

Our readers can come to their own conclusions regarding the patents situation—we came to our conclusions long ago.

In the May "Review," we made a suggestion to intending radio apparatus manufacturers and distributors, which, if followed out, will enable them to elucidate the patents position for themselves, and if they have not already done so, they should take the action we suggested without delay.

A STATEMENT WHICH IS CONTRARY TO FACT

IN a recent number of an English magazine, Mr. Fisk, of Amalgamated Wireless (Australia), Ltd., is alleged to have stated, in connection with a wireless chain for the Empire scheme, that public opinion in Australia was against the Government erecting its own high-powered station. If the statement was made, as is alleged, it is entirely contrary to fact. If anyone is competent to speak on this matter it is ourselves, as the leading publication dealing with radio matters in Australia.

It is a well-known fact that the public were never consulted in the matter.

We have had a long Parliamentary experience, and we know exactly how these things are put through.

A party leader makes up his mind to put a certain Bill through, and whether it is for the good of the country or not, once the leader has declared for the Bill, the rank and file of the party are soon whipped into line, as the party leader has plums to dole out from time to time, and every Parliamentarian of experience knows that a party member who dared to oppose his leader would stand very little chance of ever reaching Ministerial rank.

Therein lies the pull of the party leader on the members of his party.

Presently the Bill reaches the House, and the most docile of a party will go so far as to make speeches in favour of a Bill, even if they know, in their own minds, that in the interests of the country the Bill should not pass into law.

Such is the routine followed by a party leader who desires to rush a Bill through a House of Parliament.

In the case of the Bill which authorised the signing up of an agreement with the Amalgamated Wireless (Australia), Ltd., for the entering into partnership by the Federal Government with the Company, to erect and maintain a certain high-powered radio station or stations, it is possible that it came before the House via the good old party routine, which has been detailed, and the next step, that of parrying any opposition to the Bill from the Opposition Benches, would be a very simple matter, as, being a Bill dealing with a highly scientific subject, it is probable that not a single member of the House was competent to make any speech on the merits or demerits of the Bill.

This method of foisting an agreement between a Government and a private concern on the people of Australia, is far from being evidence that the people of Australia were opposed to Government control of what is largely a defence scheme. On the contrary, it shows that the people were never consulted, and we shall take care to forward to the proper quarter a refutation of the statement which Mr. Fisk is alleged to have made.

A company which, by its advertisements, declares itself to be identified with "Gesellschaft fur Drahtlose Telegraphie m.b.h. (Telefunken), a German Company, has no business to be allowed to be in partnership with the Federal Government, regarding an important branch of defence communications. That it is so will be an ever-standing reproach to our legislators.

A WORD TO THE WISE

IT is our opinion that the governing body of the great Marconi Company has not been wise in its choice of managers of its Australian business.

Those managers should be men with a breadth of outlook, men who could catch the Australian spirit and be guided by it.

The Australian spirit will not tolerate a monopoly in a public utility, which may tend to cramp, cabin and confine the development of radio science amongst the young people of Australia, nor will it toler-

ate Australia being held back in the matter of having a radio telephony service for the education, information and amusement of its people, such as is enjoyed by the people of other countries.

In America, public opinion has become so strong in connection with broadcasting and broadcast reception, that the American naval authorities have recently commenced to re-construct their sending apparatus in order to cut down interference by the naval high-powered stations with the broadcasting service to a minimum.

A big company may be very powerful, but public opinion is still more powerful.

Every legislator must realise that radio will become an important factor in the lives of the Australian people, and that it will be an important factor at the next elections. Our Parliamentary experience prompts us to point out to the managers of Amalgamated Wireless (Australia), Ltd., that the greatest power a big company can exert is but a drop in the ocean as compared with public opinion in the mind of the politician, whose be-all and end-all of existence is to retain his seat.

Any company which relies upon its power as a big concern, and forgets the politicians and public opinion, is resting on a very rotten reed indeed. And let us further point out, that at the very first breath of adverse public feeling, the politician is "on the run."

Amalgamated Wireless (Australia), Ltd., should realise that it has been fortunate in securing the big concession it has obtained at the hands of the Federal Government in the signing of the partnership agreement. Let that Company work the commercial side of the proposition for all it is worth, and be content with the benefits thereof. Let the Company remove the antagonism in its operations which has been engendered by what we consider the ill-advised actions of its managers, and seek to obtain the confidence of the Australian public by evincing a desire to assist Australian radio goods manufacturers to build up big businesses in Australia, and to bring to the people the use and benefit of radio reception and transmission.

Germany used the submarine method, and Germany lost the battle.

It is important that a large number of Australians be trained in radio transmission and reception as soon as possible, in order that, in time of need, an amateur relay scheme may be available to maintain communication from coast to coast, north, south, east and west. Herein lies the value of amateurs learning the art of transmission and reception.

It is equally important that the people of Australia have the educational and uplifting advantages of broadcasted radio telephony.

It is just as important that young Australians be afforded the opportunity of becoming radio scientists and add their quota to the world's radio inventions and improvements.

Anything or anybody that stands in the way of all this is inevitably going to be swept out of the way by an indignant Australian public.

Either the present managers in Australia of the Marconi Company must develop that breadth of mind and outlook which will prompt them to see that the course we have outlined is the correct one in the best interests of the Marconi Company, or the governing body should send out to Australia to manage their affairs the right men to catch and chime in with the great Australian spirit.

BROADCASTING

A MEETING is shortly to take place in Melbourne for the purpose of discussing the broadcasting position with the Postmaster-General. Everyone concerned should see to it that they are represented at that conference. This embraces amateurs, radio goods manufacturers and distributors, and newspaper proprietors. It is to be hoped that a Broadcasting Company, on the lines of the British Company, will be the outcome of the conference, and the company should be framed on the same lines, and provision be made to enable the smallest manufacturer of radio apparatus to become a member, and so do away with any suspicion of the company becoming a monopoly. Nothing less will satisfy the Australian public.

Newspaper proprietors should specially watch their own interests, as the time will come when they will see that to broadcast news, for the benefit of both country and townspeople, is to their best interests. This can easily be arranged by providing a different wave length for transmission for newspaper office and Broadcasting Company transmissions.

All concerned should see to it that the fee to be charged as licence fee for receiving broadcasted concert is kept so low that practically the poorest amongst us may avail themselves of its benefits.

Having a relatively small population, special means will have to be adopted to augment the revenue necessary to carry on a broadcasting service. In this connection, our contemporary, the "Wireless Weekly," of Sydney, made a valuable suggestion some time ago. The suggestion was that a certain amount of advertising should be allowed to be transmitted by the Broadcasting Company. At the theatre, the placing of advertisements on the sheet, during the interval, has come to be looked forward to as a means of passing the 10 or 15 minutes of the interval time, and if, say, fifteen minutes were allowed for advertising for each two hours of transmission no one would complain, and the voice of the speaker would be valuable for testing out receiving sets with, and adjusting them to get the best results. A considerable revenue could be gained in this way, which would permit the Broadcasting Company to keep up an attractive programme, and at the same time would allow the broadcasting reception fee to be reduced to the absolute minimum.

Photographs for Competition

STATION of Mr. A. Keith Symes, of "Glenroy," 62 Middlesex Road, Surrey Hill, Victoria. The set includes a loose-coupler with two sliders on the primary, which is 7½in. by 5½in., wound with 286 turns of 24-gauge enamelled

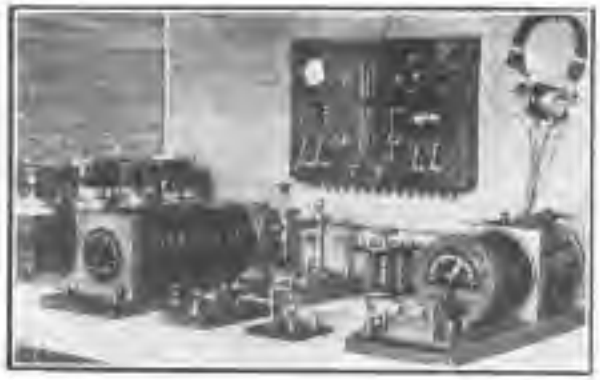
wire. The secondary has 10 taps and is 7½in. by 4½in., and is wound with 385 turns of No. 27-gauge enamelled wire. A .001 mfd variable condenser is shunted across the secondary, and the headphones are Brown's 8000 ohm. There are also a 6 volt accumulator, a transformer and key for learning Morse. Call sign 3 I.W.

* * *

PHOTOGRAPHS of the Sea Scout Cruiser "Wanderer," one being of the inside of the cabin, where a two-valve receiver and C. W. transmitter, using three "Q" valves, are installed. Hal. McKorl, the Skipper, sends the photos

along, and reports that the "Australasian Wireless Review" goes aboard regularly, and that it is much appreciated. Views of this description make us feel that we are really waking up to wireless possibilities in Australasia, and when all the owners of small craft add the joys of radio concert to their pleasure excursions on the water, not to mention the real service a small receiving and transmitting installation can be in time of emergency, we shall begin to realise that we are getting into step in the march of progress and civilisation. These photos take the prize this month for the Best Novelty Photo.

* * *



THIS is the very efficient-looking station of Mr. A. G. Naunton, of 7 Montclair Avenue, North Brighton, Vic. The set is one employing a crystal, and was made entirely by Mr. Naunton in 1918, at which time he was only 16 years of age. The apparatus includes a large loose-coupler, a loading coil, a variable condenser, two crystal detectors, a transmitting key, and batteries for a test buzzer. The switchboard has two single-pole, double-throw knife switches, a micrometer spark gap, a voltmeter, a two-way switch, a three-way switch and a fixed condenser switch. The terminals along the bottom are for the purpose of connecting up the instruments. This photograph takes the first prize in the Photo Competition, and we compliment Mr. Naunton on the neat and workmanlike appearance of his set.

* * *

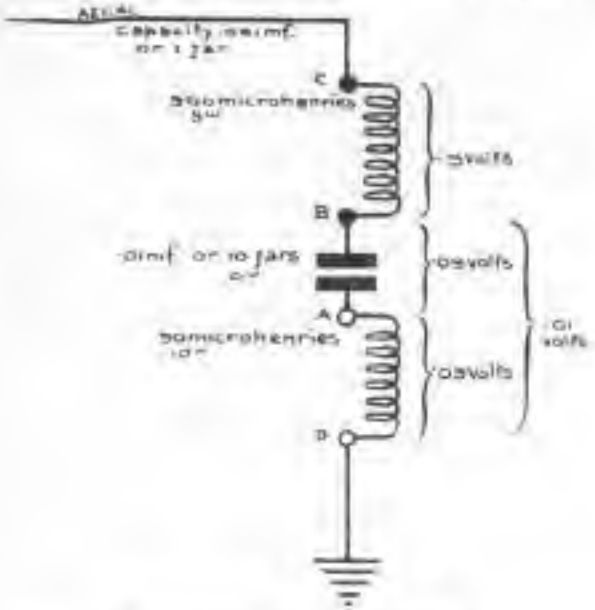
STATION of Mr. Frank L. Carbines, of 93 Cobden Street, South Melbourne. The apparatus includes a loose-coupler, with a variable series-parallel condenser in the primary circuit, and another one in shunt in the secondary circuit. A crystal detector is used, with the usual telephone blocking condenser and headphones. Mr. Carbines gets the best results with galena. He gets the Amalgamated Wireless Concerts on Monday evenings, and the numerous amateur transmitters around Melbourne. He intends to instal a valve set at an early date.

Losses in a Receiving Circuit

By "X"

WHEN erecting an aerial for receiving purposes, it is desirable to guard against the following losses:—

Resistance Loss.—A certain amount of energy must be lost in the conductors, but this inevitable loss can be kept down a loss of low value by (a) using conductors of large surface area, such as copper strip, tubing, or stranded wire; (b) keeping connections clean and tight; (c) using a fair ratio of inductance to capacity. In connection with the latter, it should be noted that the resistance loss in the inductance is much greater than the hysteresis loss in the condenser. On the other hand, the more inductance and the less capacity in the circuit, the "stiffer" or more selective the circuit becomes.



Voltage to earth and effect of resistance

Capacity Losses.—These may be avoided by keeping the aerial lead in, instruments, and wiring between the instruments at a fair distance from earthed or semi-earthed objects.

Earth Losses.—A water pipe forms a fairly good earth if the lead from the instruments is soldered to it, but it is advisable to run a wire from the water-pipe, of the same dimensions, and covering the same area as the aerial.

Insulation Losses.—Rubber should not be used for insulating the aerial, as it is no insulation at all when receiving continuous waves, particularly those of long wave length. Porcelain is the most suitable. High potential points of the receiving circuit need to be carefully insulated. These points may be found by touching various places in the circuit and noticing when incoming signals are reduced in strength.

The sketch and calculations given herewith show voltage to earth at various points in the receiving circuit, and indicate the effect of resistance.

It is assumed that a current of 1 milliamp is flowing and that the circuit is tuned to 1880 metres.

(a) $2\pi f$ or $p = \frac{3 \times 10^8}{300} = 10^6$

(b) Reactance A–D $= pL = 10^6 \times \frac{90}{10^6} = 90\omega$

(c) " A–B $= \frac{1}{pC} = \frac{1}{10^6} \times \frac{9 \times 10^6}{10^5} = 90\omega$ (capacitive reactance)

(d) Impedance D–B $= Z = R$ (ohmic resistance 10ω) — pL and $\frac{1}{pC}$ balance

(e) Voltage $\begin{cases} A\text{–}B \\ A\text{–}D \end{cases} = .09$ Volts

(f) Volts B–D $= IR = 10 \times \frac{1}{10^3} = .01$ Volts (due to resistance)

(g) Reactance B–C $= X = pL = 10^6 \times \frac{900}{10^6} = 900\omega$

(h) Volts B–C $= 900 \times \frac{1}{10^3} = .9$

(i) Therefore power required to maintain oscillations depends entirely on the ohmic resistance if circuit is in resonance. In the example given it

I^2R where $R = 5\omega + 10\omega$

$\frac{1}{10^3} \times \frac{1}{10^3} \times 15$ watts

15 microwatts

POWERFUL FRENCH STATION EXCELLENT IN TESTS WITH NEW YORK.

ACCORDING to a Reuter news dispatch, the radio station of Sainte Assize in France, which has been under construction for the past two years, has unofficially opened communication with New York. The American technicians in communication with the French station, which is the most powerful so far constructed, state that they consider it gives the clearest signals they have ever received from France. The new station will be placed at the disposal of the general public as soon as the authorisation of the French Government has been given.

NAUEN.

THAT famous long-distance radio station, Nauen, in Germany, is to be altered so as to increase its range and to meet the increasing traffic in the United States and Argentine Republic. Twenty-five million marks additional capital is being raised by the Trans-Radio Company, and a beginning has already been made with the constructive work. The plans include the erection of seven new masts, each 689 feet high, and the dismantling of four of the existing masts. Until now the Nauen signals have been picked up in the United States by amateurs possessing tuners of extreme wave length range, as well as vacuum tube detectors and two-stage audio-frequency amplifiers.

Dr. Alexander Graham Bell

IN the early days of telegraphy, there were hosts of experimenters who rigged up telegraph lines and sent messages to each other in the Morse Code. A youth who did not know anything of the telegraphic science in those days, was very much out in the cold, and amongst these experimenters was a young man in Boston, U.S.A., by the name of Alexander Graham Bell, who taught the art of visible speech to deaf mutes by day, and laboured amongst coils, batteries, magnets, and vibrating reeds at night.

His goal was a harmonic telegraph system, by which he confidently expected to send six or eight messages over the same wire. The secret lay in tuning the vibrating reeds of the receivers, to correspond in pitch with those of the transmitters,—so Bell thought, and so he laboured.

Primarily, he was a student of vibrations. As a professor of vocal physiology, he had studied the human voice, the human ear, and the medium through which the voice travelled,—air.

He knew that the voice was composed of complex vibrations set up by the vocal chords in the throat; that these vibrations, when modulated by the tongue and lips and expelled from the mouth, set up a mass vibration in the air in the form of sound waves, which waves, impinging on the drums of the listener's ears, caused them to vibrate and produce the sensation of sound.

Bell knew that the air varied in density according to the vibrations of the voice. By his experiments with the vibrating reeds, he knew that when a receiving reed was tuned to the same pitch as that of a transmitting reed, it would vibrate in unison, and that a current of electricity would carry the vibrations.

He reasoned that if he could make a current of electricity vary in intensity, precisely as air varies in intensity during the production of a sound, he should be able to transmit speech telegraphically. Here was the underlying principle of the wire and radio telephone! The varying in intensity of an Electric current, or carrier wave, according to the complex vibrations of the voice.

In experimenting with the harmonic telegraph, Bell's assistant operated a transmitting key, just as the telegraph operator does to-day, making and breaking the contract. The reed over the transmitter vibrated, and as the reed over the magnet of the receiver was tuned to the same pitch, it would vibrate harmoniously with the transmitter.

One day, an accident happened. The transmitting reed stuck down on the magnet, forming a closed connection and a steadily flowing electric current. The assistant tried to pull the reed away, which he caused to "twang" when so doing. The faint twang was heard by Bell at the receiving end, he recognised the varying vibration, the complexity of pitch as the twang ranged from high to low, and he knew that if a complex sound like that could be transmitted electrically, the complex vibrations of the human voice could be transmitted equally well.

The telephone was discovered, without which, radio telephony was, of course, impossible.

Dr. Bell's contribution to the science of voice transmission will ever be remembered by all who enjoy the benefits of both the land line telephone, and the radiophone, in concert transmission and reception.

Radio Discovers Australian Scientists

The Wonderful New Australian Radio Valve

AS a general rule, scientists pursue the more or less even tenor of their way, unsought and unheard of. Suddenly the world is startled by some wonderful discovery, the successful outcome of a long course of patient research, with its numerous initial failures. The discovery may be something which will materially aid the health or increase the well-being, convenience, and enjoyment of the human race, and the value of scientific research is tardily acknowledged by a more or less apathetic public.

During the war it was necessary that radio valves be manufactured in Britain, to keep pace with the demands for "listening in" apparatus for both the army and the navy.

Under Professor J. J. Thompson, in charge of the Cavendish Laboratory at the Cambridge University, valves were produced for war purposes, mainly for the navy, both of the detector and amplifier types.

Mr. A. J. Garrod, of Sydney, N.S.W., was a student at the Cambridge University at this time and for over two years he had the opportunity of studying valve construction as carried on at the Cavendish Laboratory.

After the war, and shortly after his arrival in Sydney, Mr. Garrod met a kindred spirit in Mr. S. Radcliff, an industrial research chemist, who had specialised in high vacua work, mainly, up to that time, in connection with X-Ray Tubes, and in the production of modern high vacua pumps.

Here was just the right combination to produce, what Mr. Garrod had in view, the ideal radio valve.

The construction of valves necessitates, first of all, perfectly balanced elements. The plate, the grid and the filament must be carefully designed in relation to each other to produce a high standard of efficiency. The research work conducted at the Cavendish Laboratory had conveyed to Mr. Garrod all the information necessary to achieve that end.

The next step in valve construction is to so exhaust the glass bulb that the electrons thrown off by the filament have a free and unfettered path to the positive potential on the plate, and the residual gases in the elements have to be eliminated in order that the gas molecules shall not interfere with the free flow of filament electrons. This latter is a highly important matter, perhaps the most important matter pertaining to valve construction.

Mr. Radcliff's knowledge of vacua phenomena enabled him to deal with this important problem very effectively, and special apparatus was devised for this purpose.

It was conceived that it was possible to produce a valve that would operate at the highest state of efficiency, both as a detector and an amplifier, and with a minimum of difference of plate potential when employed for either purpose.

For many months, careful and painstaking research was pursu-

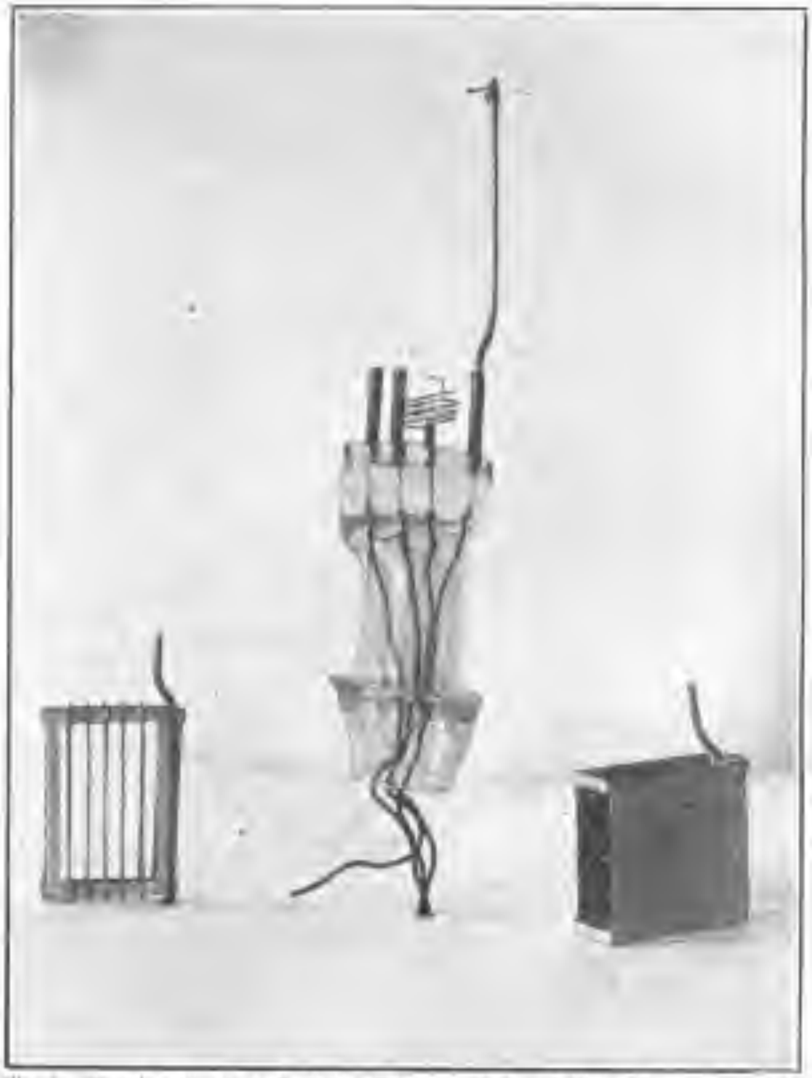


Fig. 1.—Showing the G. & R. Valve Filament Grid and Plate Elements. (Note the small tension spring at the top of the filament connector).

ed, during the course of which apparatus was devised, constructed, and perfected, and we have no hesitation in saying that the highly scientific apparatus now employed in constructing the G. and R. Valve is second to none in the world, not even, excepting that employed in the huge research laboratories of the great American valve manufacturing companies. As a matter of fact, the Garrod and Radcliff apparatus, for producing radio valves is the best yet known to the world of science.

By the courtesy of both gentlemen, the writer had the privilege recently of going through the G. and R. Company's laboratories, just outside Sydney, when the wonderfuly complex apparatus was demonstrated. The finished product was tested, both as a detector and as an amplifier, in the writer's presence, and the results were absolute perfection.

As a detector, the valve operates on a plate potential of 20 volts, and an increase of 10 volts gives the peak of amplification efficiency, the main feature of the valve being that its characteristic curve is a "straight line" curve throughout the whole course of operation. As much as 200 volts may be impressed on the plate without any of the well-known "bluing" appearing, and which indicates impending ionisation. There is no advantage gained, however, by increasing the plate voltage, as maximum amplification is attained with only 30 volts on the plate, and there need be no hesitation in stating that, at that potential, the valve functions as an amplifier, equal to any valve that has ever been manufactured, and that is saying a great deal, but it is said advisedly.

The diameter of the valve is about one inch, and it is about 3½ inches long overall. Four contact pins are secured in the base for the connections, but as the valve is smaller than the standard American four pin valves, a special socket is being manufactured by the Company, which will act as either an adaptor, to plug the valve into standard four-pin valve holders, or it may be used as a valve holder proper, screws in the base being provided for mounting purposes.

Being an Australian production, there are no duty, exchange, and transportation charges to pay, and the Company has wisely decided

Fig. 2. The Complete G. and R. Valve

to give Australians the benefit of this and has provided that the G. and R. Valve may be retailed at 21/6.

Arrangements have already been made with a large British concern for the distribution of the Valve in Great Britain, and the distribution in New Zealand has also been arranged for.

Don't Forget: One Subscriber for One Reader will double Review circulation and enable us to increase the number of Review pages

Ultra Amplification

SINCE the advent of the Armstrong Super-Regenerative Circuit, there seems to be a growing tendency to delve into methods of securing ultra-amplification, hitherto neglected.

In the Armstrong circuit amplification of an impressed E.M.F. is advanced beyond the normal range of the valve by means of the sheer force of oscillations produced by an auxiliary circuit.

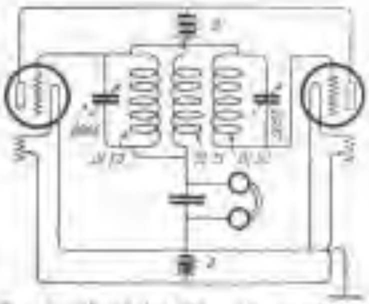


Fig. 1. Multiple Valve Regeneration.

In the methods to be dealt with herein, amplification is attained within the circuit itself, without the aid of an auxiliary circuit, or externally produced oscillations.

Although these circuits differ, the "Theory of Negative Resistance" may be applied to both of them.

In dealing with energy in a state of oscillation, there is an element of vital importance to be considered. This is the time element. It manifests itself by means of the retardation or impedance of the circuit to any impressed E.M.F. or alternating current. In the Armstrong circuit this is compensated by directly increasing the voltage in the grid circuit by means of externally produced oscillations, and in the methods under review, by doubling-up on the circuit and increasing the current in the plate circuit which, in turn, increases the potential in the grid coils. Whilst the Armstrong circuit is difficult for the novice to handle, the "double-back-action" circuit is easy to construct and manipulate.

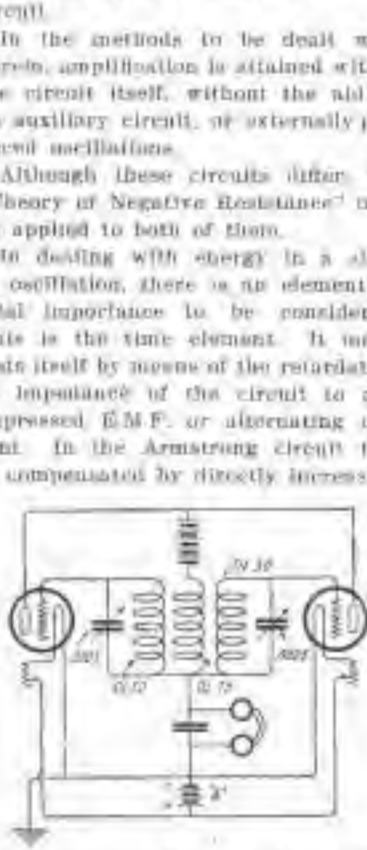


Fig. 2. Another Form of the Circuit.

The latter has points in common with the simple regenerator and the super-regenerator, and under good conditions we may obtain results somewhat approaching those of the super-regenerator with the circuit of Figure 2.

The outstanding feature of the inter-valve regenerator in comparison with the simple regenerator is its range and selectivity.

The circuit of Figure 1 gives maximum results in these matters. Figure 2 is a circuit which is easier to tune, but is not so selective.

is in series with the aerial, is connected to the plate side of the 25 turns honeycomb. A loop aerial must be of greater inductance than the plate coil, and it is shunted across the plate coil. By earthing the filaments, stations 500 miles distant have been picked up without any kind of aerial. In this case the plate inductance was one of 75 turns. Whichever kind of aerial is used, the filament is always earthed.

The circuit of Figure 3 gives very powerful amplification, used with Radiotron Valves U.V. 201, with 110 volts "B" battery on the plates. The grid coils X and Y may be connected up as in Figure 1, if desired.

U.V. 1714 radio-frequency transformers are suitable for this circuit, but any efficient transformer will give good results.

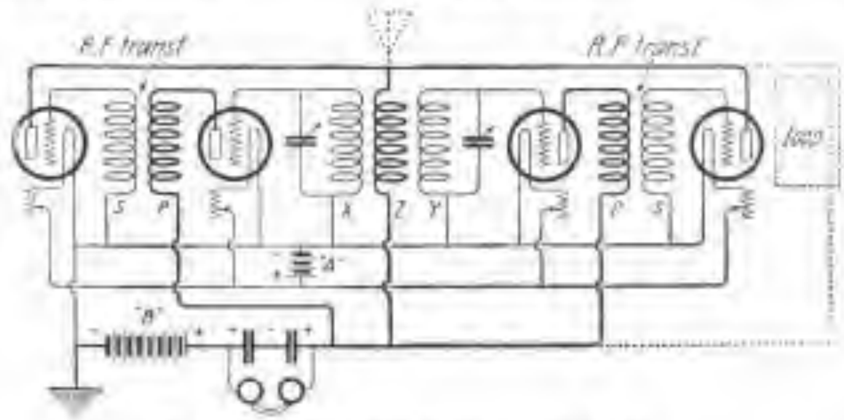


Fig. 3. The Circuit with Radio-Frequency Added.

The inductances used are honeycomb coils, and those having the three-coil mounting may change over to these circuits very quickly.

A slight change may be necessary in the condensers, as those of .0005 mfd. are most suitable for wave lengths from 200 to 600 metres. The sizes of the coils used are shown on the diagrams.

For wave lengths from 200 to 400 metres, honeycomb coils of 35 turns each are used in both grid circuits.

The plate inductance depends on whether an outside aerial or a loop is used. With an outside aerial a honeycomb coil of 25 turns in series with a condenser of .0005 mfd., may be tried.

The lead from the condenser, which

The diagram of the Ultra-Audion system is shown in Figure 4. Any number of valves may be used in this circuit by employing radio-frequency transformers in place of the coils X, Y.

The valves are placed in cascade with coil Z, and are connected from the grid of the first valve to the plate of the last as shown in the diagram. Care must be taken to have the potential on the last valve of the proper sign, otherwise, instead of amplification, diminution is produced. If such is the case it may be rectified by reversing the connections of the secondary of the last transformer. If the circuit is connected exactly as shown in Figure 4, a triple honeycomb coil mounting may be used for coils W.X.Y. Coil Z may also be inductively coupled

to X. The values of the coils are: W, Y, and Z, 35 turns; for coil X 50 turns.

If the inductances X and Y are replaced by a radio-frequency transformer, the aerial circuit may be coupled inductively to coil Z as shown in the diagram by dotted lines. Excellent results have been obtained by using coils X and Y alone, coil Z being

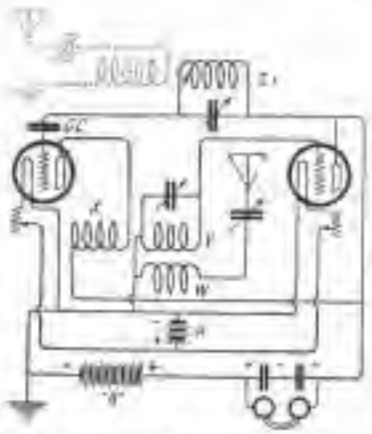


Fig. 4. Double-back-action Incorporated with the Ultra-Audion Circuit.

a loop aerial of the correct size and inductance for the wave length to which X and Y were tuned. All the condensers used in this circuit were .0005 mfd. maximum except the grid condenser, which was a fixed .00025 (two .0005 in series) mfd.

In all these circuits the plate current of all the valves must pass through the phones. This is a vital factor in producing volume; it also serves to keep high resistance out of the oscillating circuit, which is imperative where regeneration is concerned. The phone condensers should be between .002 to .005, using two in series across the phones. The reason for having two condensers in series will be understood upon noting the signs + and —, which are next to each of them. This method theoretically decreases the tension between the phone terminals, but this is compensated for by increased regeneration and smoother oscillation.

The plate voltage of each circuit should be maintained at about 90 to 110 volts when U. V. 201 valves are used. For Myers Valves 45 to 60 volts are sufficient. For the circuit of Figure 3, 5 watt valves with 350 volts on the plates may be used to produce the best results, and a loud speaker can be substituted for the phones.

Figure 2 circuit is an excellent one for C.W. either straight or modulated, or phone, if the 5 watt valves are employed. The aerial is connected to the plate side of the tickler and the filament to earth. For transmitting, the inductances should be of the pancake type made up of copper ribbon as in the ordinary oscillation transformer. This circuit is also an excellent relay and may find a great field of usefulness in country towns, where concert from the cities may be picked up and relayed to listeners in, within a radius of, say, 50 miles.

Another method of using the "double-back-action" circuit is shown in Figure 5, which has a direct-coupled aerial. In the plate circuit of the first valve is the so-called rejector circuit L2., C2., tuned to the incoming wave lengths. The lower end of L2 is connected through the grid condenser C3. to the grid of valve V2. Instead of having a reaction coil in the plate circuit of the Valve V2. and coupling this coil either to the inductance L1., or the inductance L2., it is arranged that reaction is introduced, not only into the circuit L1., C1., but also into the circuit, L2., C2. This is effected by having two variable reaction coils, L3. and L4., L3. being coupled to the inductance L2., and inductance L4. to L1., each being so coupled that a reaction effect takes place. It is very important to see that the connections to the coils L4. and L3. are the right way round.

To test, short circuit L4. Tune the aerial circuit and the rejector circuit until the loudest signals are heard, the coupling between L3. and L2. being kept very loose; then bring L3. up to

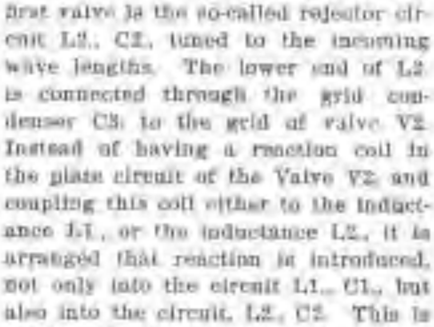


Fig. 5. The Circuit with Two Reaction Coils connected in Series.

L2. and note if an increase in signal strength is obtained, the circuit L2., C2., being carefully adjusted at the same time.

If the signals increase in strength the connections are right, but if there is a decrease, the connections to coil L3. should be reversed. Next L3. is short-circuited, and the coil L4. is brought close to L1. The signal strength should increase if C1. and C2. are correctly adjusted. If the signal strength is decreased, the connections to L4. should be reversed. L3. is now unshorted, and both couplings should be loose. L3. is brought closer to L2. and condenser C2. is adjusted to keep the signals at maximum. At a certain point V2. will oscillate, which may be prevented in the usual way by ad-

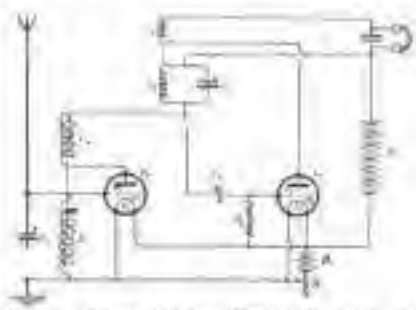


Fig. 6. Each Valve Provided with its Own Reaction.

justing the coupling between L3. and L2. The inductance L4. is now brought closer to L1., and the circuit L1., C1. is carefully re-adjusted until the loudest signals are obtained without oscillation setting in.

It will be found that the aerial tuning becomes very much sharper. The best results are obtained by carefully adjusting the couplings between L4., L2., and the two reaction coils, the condensers C1., C2., being adjusted to get the loudest signals without self-oscillation being produced.

It will be found that tightening the reaction on the first valve between L4. and L1. will simultaneously increase the reaction between L3. and L2. and an even balance must be maintained to avoid self-oscillation. It will be found that either the inductance L4. is loosely coupled to L1., and L3., tightly coupled to L2., or vice-versa, or an average couple of each is necessary.

Figure 6 shows another circuit in which the reaction coils are not connected in series. Instead, the first valve provides its own reaction on its grid circuit and the second valve does the same. A reaction coil L4. is used for obtaining the reaction on the first valve, and a reaction coil L3. is also coupled to the rejector circuit L2., C2. This circuit is operated similarly to the circuit of Figure 5.

Figure 7 is the circuit of Figure 5,

with two stages of audio-frequency amplification added.

In the ordinary circuit, oscillation sets in long before maximum signal strength is reached. By means of double reaction, separate reaction is applied to the aerial circuit and to the rejector circuit, and the damping of each is reduced to the critical value preceding self-oscillation. Under these circumstances both circuits work with a damping in the neighbourhood of zero, and the greatest amplification is obtained without premature self-oscillation.

In practice, two honeycomb coil stands are used in the foregoing circuits, figures 5, 6, and 7, with two coils on each stand.

The coil L1 is a honeycomb of 25 or 35 turns, and the reaction coil L4, is one of 50 turns. The rejector circuit coil L2 is one of 50 turns, and the rejector circuit reaction coil is of 75 turns. The grid condensers are fixed and of mfd. capacity used with the particular type of valve employed.

The variable condensers are .0005 or .001 mfd. The phone condenser is the usual .002 to .005. R2 is the customary grid leak of 1 or 2 megohms resistance. R1 is the ordinary filament resistance. Hard valves produce the best results.

The voltage of the "B" battery is 100.

With the exception of the extra .0005 variable condensers, no additional apparatus is needed for an experiment with the circuits of Figures 1 to 4, provided that the honeycomb coils and stand, or panel holder, and the radio-frequency transformers are already on hand, and a method of obtaining the maximum amplification possible is well worth the little trouble involved.

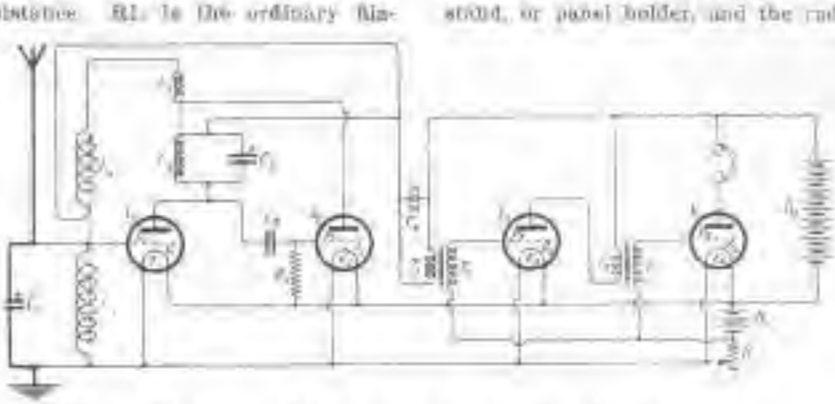


Fig. 7. The Circuit of Fig. 5 with two stages of Audio-Frequency Amplification Added.

Two-Way Radio Communication with New Zealand

TOWARDS the end of April several Australian amateur transmitters were heard in New Zealand, a distance of about 1,500 miles, on a power input of not exceeding 8 watts. This achievement is not surpassed by amateurs in any part of the world, and fully demonstrates the fact that the Australian amateur is equal, at least, to any others in the practical application of radio science.

Several reports have been received in Melbourne from Mr. F. D. Bell, of Waihemo, Otago, New Zealand, which indicate that 3B.Y., 3J.U., 3B.D. and 3M.C., of Victoria, and several amateurs in other States have been heard by him.

For three weeks previous to the reports being received, Mr. R. A. Hull, 3J.U., operating the receiver described in the March number of the Australasian Wireless Review, in its final trials prior to the Trans-Pacific Tests, had overheard conversation between two stations, "P" and "Q," on numerous occasions. Even though pages of their transmissions were logged, no clue to the identity of these stations was obtainable, until Mr. Bell mentioned in a letter that he and a fellow experimenter in Gisborne, New Zealand, operated low power transmitters, and that their call signs were "P" and "Q."

This opened the way for two-way operation. An opportunity presented itself on the night of April 26th, when 3M.C., who was transmitting on schedule, kindly agreed to ask Mr. Bell, via radiophone, if he would listen in for 3J.U., after the completion of the Melbourne transmission then in progress.

Mr. Bell received the message, and two-way communication was at once established and it was maintained for over two hours. A report from Mr. Bell states that the signals from 3J.U. (Melbourne) were very good on a loud speaker.

The signals from New Zealand were so strong that it was quite unnecessary to wear the phones, the C.W. being easily audible some 70 feet away.

A single 5 watt B.T.H. tube was used at 3J.U., with a radiation of one ampere, in an inverted "L" aerial, 40 feet high, and 80 feet long, whilst the radiation at the New Zealand station was, approximately, 1.4 amperes.

The writer of our Melbourne report states that the day after the two-way communication test, a cable was received, saying that Mr. Bell had met with an accident. No further details are to hand, but the Melbourne amateurs desire to express their sympathy with Mr. Bell and hope to hear soon of his recovery.

Wireless Pars from Everywhere

MELBOURNE AMATEURS TALK WITH NEW ZEALAND CONFRERES

MR. H. W. Maddick conveys the information that leading Melbourne amateurs have been successful in exchanging speech with New Zealand amateurs. We hope to have a full report of this achievement in hand before we go to press.

* * *

A KITE AERIAL.

THE Murray Bridge Radio Society uses a kite aerial on their "field" days, days when the apparatus is taken out into the open for practical work in reception. Some very good results of reception of long distance signals are obtained.

* * *

SPECIAL ARTICLES.

TWO articles in this issue are worth the special attention of experimenters. One, "The Best Concert Receiver," gives full details of the construction and assembly of a simple valve receiving set, and the other, "Liquid Rectifier and Condensers," is especially valuable to amateur transmitters. Directions are given for constructing liquid condensers, and a liquid condenser will be something new, even to many who have had a long experience in dealing with condensers. In the February Review, page 13, particulars were given of a liquid condenser placed on the market by an American firm, and they claim that for 5 watt sets, with two of the liquid condensers coupled in series, they act as efficiently as the usual filter consisting of a 2 mfd. condenser, double choke, and by-pass condenser, and that they effectually eliminate the a.c. hum. In the article, this type of condenser is described and it is worth every experimenter's while to make it up and test it.

* * *

DON'T HIDE YOUR LIGHT UNDER A BUSHEL.

THE biggest boom Australasia has ever known is close upon us, and good men will be eagerly sought by the companies supplying high-grade apparatus. We have plenty of capable and energetic young men in Australasia, well versed in the practical as well as the theoretical side of radio science. To these we say: "Don't hide your light under a bushel," as the old saying has it. Write up an interesting article on some phase of radio and send it along. We will insert these articles to the fullest extent possible, and will even go out of our way to make room for interesting Australasian matter. By these means you can make known your abilities and knowledge of radio science. This is the time, and the Review is your opportunity.

BROADCASTING SERMONS.

THE broadcasting by wireless of Rev. David F. Brandt's sermon at Chalmers Presbyterian Church, which was to have taken place last night, had to be postponed on account of its having been discovered at the last moment that it was necessary to obtain the special permission of the Postmaster-General before the experiment could be carried out.

This oversight will be remedied during the week, when the P.M.G. will be approached by Mr. Brandt. As soon as the permission has been obtained, arrangements will be made for the broadcasting of sermons.

Two well-known Victorians. On the left is Mr. Whitelaw, stationmaster at Mooroolbark, whose amateur station 3.B.H. is equally well-known. On the right is Mr. Maddick, the genial secretary of the Victorian Branch of the Wireless Institute.

* * *

MELBOURNE HEARS SYDNEY CONCERTS.

SEVERAL of Sydney's leading amateur experimenters have been conducting a most interesting series of tests with their brother amateurs in Melbourne. So successful have they been that the music transmitted from a Sydney amateur station, using less than 10 watts input, has been heard clearly and distinctly by several Melbourne amateurs. It must be clearly understood that the receiving station is not equipped with a simple "crystal" set, but rather with a multi-valve set, which enables the minute signal to be amplified both before and after detection.

Remember our Big Subscription Drive and get ONE Subscriber

SYDNEY AND MELBOURNE HEARD AT ARMIDALE, N.S.W.

MR. E. Barlow, Hon. Secretary Armidale Radio Club, reports that several of the Club members, including himself, regularly hear amateur transmissions from both Sydney and Melbourne. He says that 2.C.M., 2.B.B., 2.F.A. and 2.I.X. come in particularly well.

* * *

OUR ADVERTISERS.

WHEN writing to our advertisers for goods or information it is as well to let them know that you "saw it in the Review." Advertisements and subscriptions help a publication to enlarge, and we intend to make the Review, not only the brightest and best, but the biggest, also. By the way, we are starting a big subscription drive this month, and we want YOU to get us ONE subscription. If every reader will get us one new subscriber, that will double our circulation, and will enable us to considerably enlarge the Review. We want more room for the shoals of amateur contributions that are coming along, most of them, at least, conveying some worth while information for the benefit of other experimenters. Just ONE subscriber each.

* * *

MESSRS. BEN AND JOHN FULLER, LTD., LEND A HAND IN BROADCASTING, AS THE FOLLOWING PRESS EXTRACT WILL SHOW.

THE International Electric Co., Manners Street, in co-operation with A. R. Christian, Ltd., Lower Tory Street, and P. G. von Hartitzsch, 166 Moxham Avenue, Kilbirnie, broadcasted from the Ford Building, Wellington, last Friday evening, a choice programme. Through the courtesy of Mr. Walter Fuller, members of the Fuller Vaudeville Company contributed most acceptable items. The programme was as follows:—Miss A. Rubenstein, piano solos, "In a Monastery Garden" (Ketelby), "Le Caprice de Nannette" (Coleridge-Taylor); Miss Billie Jones, song, "April Showers"; Miss Patsy Hill and Mr. Vernon Sellers, vocal duet, "Mississippi"; Mr. Vernon Sellers, song, "Tommy Lad"; Mr. E. M. Hyman, of the Arnold Studios, Manners St., Wellington, violin solos "Ave Maria" (Gounod), "Moto Perpetuo," "Phantom Melody" (excerpt from "Samson and Delilah"), "The Sheik," "Now and Then," "Stumbling," "Only Just Suppose"; Miss A. and Mr. S. Rubenstein, piano duets, "Marche Militaire" (Schubert), and "Hungarian Dance No. 5" (Brahms); and Mr. S. Rubenstein, jazz items on the piano. Miss A. Rubenstein played all pianoforte accompaniments.

CHOICE OF RECORDS FOR TRANSMISSION.

AMATEUR transmitters may as well make their transmitted concert music as interesting as possible. A "Fox Trot" may be a very entertaining selection, but too much Fox Trot, as in the case of anything, is more than enough. The Fox Trot, or any other kind of selection which is made up of a jangle of loud sounds, such as some of the band selections, do not sound well over the radiophone, especially if there is the least fault in transmission. Select your records carefully. Singing records are the best of all, and come in the clearest. Next in order should be chosen, instrumental solos of piano, harp, violin, picolo or flute, or any instrument. When Fox Trots and band selections are chosen, it should be seen that the records do not give out loud, blaring, and confused sounds, as these are magnified in the transmission, and it sounds as if something is wrong with either the transmitter or receiver. Only records of fox trots or bands should be employed which yield a well sustained harmony, without blaring volume.

In a recent editorial we suggested that the gramophone companies should be pleased to loan records for amateur transmission purposes, and we believe that these companies have only to be approached in the proper spirit for this to be done.

The gramophone companies have to demonstrate records many hours in the day to intending purchasers, and a lot of this would be saved, by records being sent over the ether, as many records would be selected by those hearing them via radiophone concert.

MUSIC IN THE AIR.

AS Sydney and Melbourne amateurs keep the air busy in the evenings, up country experimenters, as well as those nearer the cities, have plenty to listen in on. A regular evening programme is being worked in Sydney, commencing at 7.30, and, by amicable mutual arrangement, certain amateur transmitters take a portion of each evening. Amongst those sending are, Mr. Crocker, 2B.B., Mr. Davis, Vaucluse, 2D.F., Radio College, 2L.I., Mr. Whitburn 2D.K., Burwood Radio Club 2I.X., Mr. Colville 2F.A., Mr. Chas. Maclurcan 2C.M., Mr. R. C. Marsden 2J.M., and Mr. Sandel 2U.W.

In addition to the evening transmissions, 2L.I., Radio College, sends regularly each luncheon hour from 12.30 to 1.30.

All of the foregoing have a wave length around 410 metres.

Mr. R. C. Allsop, Radio Engineer of the New System Wireless Co., 280 Castlereagh Street, Sydney, and 54 Market Street, Melbourne, is to commence transmitting tests on, perhaps, 350 metres shortly, and the transmission tests will be conducted during the luncheon hour.

To help to popularise wireless concert reception, some enthusiastic amateur who can spare the time should send in the afternoons from three to four-thirty, so that afternoon tea parties, both private and in the public resorts, could install concert receivers for the entertainment of their guests.

Live firms dealing in radio apparatus would undoubtedly loan receiving sets to well-known afternoon tea resorts to set the ball rolling and to let the public in general know what wireless concert reception means.

Group of Members of Murray Bridge (S.A.) Radio Society.

NEWS FROM MURRAY BRIDGE, SOUTH AUSTRALIA.

MR. Francis G. Miller, Hon. Secretary of the Murray Bridge (South Australia) Radio Club, reports that at his station, 5.B.F., he regularly picks up all Australian 600 metre signals, and has heard boats up to 1500 miles distant on a one valve regenerative set, and good readable signals up to 1000 miles with a crystal detector set, using galena. For ordinary crystal and non-regenerative work he prefers the vario-coupler as an inductance, and for oscillating circuits, the spider-web or basket type of coil. He says that he has always got very good results with certain American valves, but recently had the opportunity of trying two of Continental make, which gave him double strength signals on 40 per cent. of the filament current used by the American valve, and found that no "B" battery taps were needed, as the Continental valve oscillated over a wide range of "B" battery voltages. He has just been granted his transmitting licence, and is installing a transmitting set in which he will employ a Mullard 5 watt valve as oscillator. He will use grid modulation.

One of the Murray Bridge Radio Club members is fitting up a wireless set on a river steamer, the S.S. Tyro, the aerial being two cages, six wires each 18in. diameter, and 40 feet long.

As Murray Bridge is 60 miles from Adelaide, experimenters experience some difficulty, at times, in obtaining wireless accessories and renewals.

* * *

BROADCASTING IN NEW ZEALAND.

NEWS comes to hand that broadcasting is in full swing in New Zealand. The International Electric Company of 91-93 Courtenay Place, Wellington, N.Z., is one of the broadcasters and with only 15 watts input, 2 amps are radiated in the aerial, and this firm's concerts have been heard all over N.Z., with single valve receivers. The International Electric Co. is the Australasian agent for the De Forest Company, and a number of other representative radio goods manufacturers.

Recently, a concert programme was heard in full by Mr. Frank H. Hobbs, an amateur, of Arden Street, Hamilton, which is 248 miles from Wellington.

Mr. L. S. Sparkman, of Ponsonby, Auckland, heard this Company's concerts on a home-made single valve regenerative receiver, the distance covered being 304 miles. Another Aucklander, Mr. A. Gee, of Devonport, also heard these concerts. His set is one of three valves, one detector, and two steps of audio-frequency, and the music was brought on a loud speaker which could be heard 20 feet away, quite loudly.

One Subscriber for one Reader will double the "Review" circulation and enable us to increase the number of "Review" pages.

A NEW ZEALAND BROADCASTED CONCERT PROGRAMME.

Monday Nights.

DE Forest Station, Wellington, 15 watts, vocal, instrumental and gramophone items, 7.30 p.m. till 9.30 p.m.

Tuesday Nights.

Auckland Radio Service, Auckland, 500 watts, player piano and gramophone items, lecturettes and news, 8 p.m. till 9.30 p.m.

Federal Wireless Service, Newtown, Wellington, 15 watts, gramophone items, 7.30 p.m. till 9.30 p.m.

Wednesday Nights.

Auckland Radio Service, Auckland, 500 watts, vocal and instrumental items, 8 p.m. till 9.30 p.m.

Federal Wireless Service, Newtown, Wellington, 15 watts, gramophone items, 7.30 p.m. till 9.30 p.m.

Thursday Nights.

Auckland Radio Service, Auckland, 500 watts, player piano and gramophone items, lecturettes, and news, 8 p.m. till 9.30 p.m.

Federal Wireless Service, Newtown, Wellington, 15 watts, gramophone items, 7.30 p.m. till 9.30 p.m.

Friday Nights.

Auckland Radio Service, Auckland, 500 watts, vocal and instrumental items, 8 p.m. till 9.30 p.m.

De Forest Station, Wellington, 15 watts, vocal, instrumental and gramophone items, 7.30 p.m. till 9.30 p.m.

Broadcast concerts will shortly be sent out from Taihape, 15 watts, Dunedin, 500 watts, and Christchurch.

In view of the fact that broadcasting is about to be put on a regular basis, the following table of wave-lengths will be useful for owners of receiving sets:—

	Metres
Auckland	260
Palmerston North	346
Wellington	275
Christchurch	380
Dunedin	370

* * *

SPEECH TO NEW ZEALAND.

ONE enthusiast is now making arrangements to conduct a series of tests with New Zealand, and he is confident that he will be able to speak to his friends before very long.

On Saturday night all those who donned the headphones were delighted with the various programmes they heard. Mr. Crocker, of Marrickville, was conducting some tests with a friend of his, and he certainly has brought his station up to a state bordering on perfection. His music and speech come in clear and distinct, not accompanied by any squeals or noises.

Mr. Basil-Cooke's experiments with the observatory were also productive of good results, and 2 L.J. is certainly holding its own. At 8.30 p.m., Mr. Colville rendered a very fine programme. It is worthy of mention that Mr. Colville was one of the pioneers in radiophone transmission in Brisbane, where as secretary of the Wireless Institute in that city, he achieved great success. It is to be hoped that many more will follow in Mr. Colville's footsteps.

* * *

RADIO DANCING.

A CONTEMPORARY expresses the opinion that the advent of broadcasted dance music will cause the introduction of special steps with radio titles. The possibilities are alarming, and the moment the paragraph was perused Wireless Wobbles and Condenser Crawls loomed up in all their gauntness. No doubt Dielectric Dips, Loading Coil Lounges, Microphone Minuets, Heterodyne Hops, Thermionic Trots, Wave-length Wobbles, etc., will figure prominently upon future dance programmes. Where will it end? Probably in a Short Circuit Shiver—the supper dance.

* * *

A NEW "STUNT."

A STRANGE use of wireless is reported from Chicago, where at the Cook County Fair a horse named Radio has been trained to circle the track at top speed, riderless and driverless, but accoutred with a wireless receiving outfit in place of ordinary harness.

The owner and trainer of the horse sits in the grand stand and sends all his commands by wireless.

It looks to me as if the jockeys will soon be jobless. Fancy a Radio Derby!

* * *

SUNDAY AFTERNOON AND NIGHT

THE weather not being of the best yesterday, and with a cool wind, the head-phones gave another means of passing the time, and music and speech were again prevalent in the air for a considerable period. The selections were all classical, with the exception of a few jazz pieces, but they were all appreciated.

From 7.30 p.m. to 8.30 p.m., one of Sydney's leading experimenters conducted some excellent tests. This amateur has changed his wave-length from 1350 metres down to 400, so that his well-known and much appreciated experimental transmission tests will be about the same wave length as the others.

As before mentioned, the amateur transmitters have decided that, in order to get the best results, only one station will conduct radiophone tests, so that the others can co-operate, and so advance the science and their knowledge.

* * *

BROADCASTING OFFICIALLY OPENS AT AUCKLAND, N.Z.

A PERUSAL of the foot-notes to the concert programme will show how the dealers concerned propose to recoup the cost of furnishing the broadcasting.

OFFICIAL OPENING AND CONCERT.

The Auckland Radio Service Station (call 1.Y.A.), Scots Hall, will officially commence Wireless Broadcasting THIS (FRIDAY) EVENING, at 8 o'clock. Wave length, 260 metres. A Pianoforte solo will be played at 7.45 p.m., to enable listeners to "tune in" and adjust receivers.

PROGRAMME.

1. "It Must be Someone Like You," Pianoforte Solo ... ... (Fox Trot)
2. "Wedding of Sandy McNab" (Song) MR. J. D. SWAN.
3. Item, Selected (Saxaphone Solo) MR. H. G. CATER.
4. "Poet and Peasant" (Pianoforte Solo)
5. "Football Match" (Recitation) MR. J. D. SWAN.
6. Item, Selected (Saxaphone Solo) MR. H. G. CATER.
7. Song, Selected ... ... MRS. LEWIS EADY.
8. "Avalon" ... ... (Fox Trot)

Listeners please note that there will be an interval of 5 minutes following each item.

Musical arrangements by Messrs. Lewis R. Eady and Son, Ltd., Bishop Sterling Piano.

Those interested are asked to note that the only Radio Dealers at present contributing to the cost of this Broadcasting are Messrs. Lewis R. Eady and Son, Ltd., V. R. Johns, Radio Limited, and Hartle Gray and Co., and it is suggested that purchasers of Radio Sets and Material should in fairness and their own interests, support those who are bearing the cost of this service.

Broadcasting will be continued Tuesdays, Wednesdays, Thursdays, and Fridays in each week until further notice. Programmes will be duly advertised.

What Wave-Length Means

THE term "wavelength" is really self explanatory, for it is generally understood that the impulses from a transmitting station assume somewhat the form of a wave. Wavelength is, obviously, the size or length of the wave in metres (1 meter = 39.37 inches).

Electromagnetic impulses (radio waves), under practically all conditions, and *regardless of length*, travel 300,000,000 meters in one second, during which time a certain number of waves are sent out. If only one wave leaves the antenna each second, the first part of it will travel three hundred million meters before it is broken off and a new wave starts—or, in other words, the wave is "stretched" over a distance of three hundred million meters. If the frequency is two, the first wave will travel one hundred and fifty million meters, in only one half a second, before it is terminated by the commencement of the following wave. If the frequency is three, the wavelength will be 100,000,000 meters, etc., thus establishing an evident relationship between frequency and wavelength: 300,000,000 divided by either quantity giving you the other. The frequency of a two-hundred meter wave (300,000,000 ÷ 200) is 1,500,000 while the wavelength at a frequency of one million cycles (300,000,000 ÷ 1,000,000) is three hundred meters. It will be observed that frequency varies inversely with the wavelength and short waves are often referred to as "high frequencies."

The above relationship, stated in a mathematical formula, is

$\lambda = \dfrac{V}{N}$ and, transposing, $N = \dfrac{V}{\lambda}$ where λ = wavelength in meters, N = frequency in cycles per second, and V = velocity of radio waves in meters per second.

It is evident from the above that wavelength, in one sense, does not directly affect the number of turns of wire on a receiving coil. However, more than one tyro in his desire to receive 360-meter stations, has multiplied 360 by three (three feet to the meter), and, zealously wound 1080 feet of wire on a tuning coil!

But, in a less literal way, wavelength does determine the amount of wire on our receiving instruments. Alternating currents (radio currents are alternating currents of high frequency) in traversing a circuit, such as from antenna to ground, experience not merely the retarding effect of resistance, but also that of "reactance." Positive reactance is a result of inductance, a quality existing in almost every circuit, which causes the amperage and voltage to reach their maximum strengths at different moments. Work, such as turning a motor or actuating a telephone receiver diaphragm, can be best accomplished only when volts and amperes work in unison (giving watts). Reactance thus results in loss of power, which, in small radio currents, makes reception impossible. To overcome this negative reactance, condensers are introduced into the circuit, which, when properly balanced, exactly counteract the reactance caused by inductance, bringing the lagging amperes back into phase with the volts, thus permitting work to be accomplished. *But reactance varies with the frequency of the current, and, therefore, at different waves, various values of condenser and coil windings (inductances) must be used.* Tuning is nothing more than a balancing of the two kinds of reactance, positive and negative, so that at the wavelength to which the receiver is tuned, they nullify each other and the weak radio currents will encounter only the comparatively negligible effect of resistance.

The Best Receiver for Radio Concerts

WHAT is the best kind of receiver for radio concerts? For the benefit of our readers we have conducted a great number of experiments with a view to answering that question.

The ideal receiver for radio concerts must comply with the following conditions:—

1. The highest efficiency, giving the greatest sound volume, combined with clarity and freedom from distortion.
2. Simplicity and ease of operation.
3. Cheapness of construction.
4. Stability.

In order to secure these leading essentials, almost every imaginable kind or type of circuit has been tested, and the receiver about to be described is the one which is capable of yielding absolutely perfect results.

The inductance is a single slider, having 80 turns of No. 22 gauge, enamelled wire, wound on a cardboard, ebonite or wooden former, three inches in diameter by four inches in length. The end pieces are 3½in. x 3½in., and are of any suitable dry wood, one quarter to three-eighths of an inch in thickness. If a cardboard or ebonite tube is used, two discs will be required to fit inside the ends of the tube, and these discs will be screwed to the two square end pieces. The tube is screwed to the discs.

The "tickler" is a honeycomb or duo-lateral coil of 100 turns.

The variable condenser in the aerial circuit is of .001 mfd. capacity, and it is an advantage if it is of the vernier type.

The grid condenser is a fixed one of .0005 mfd., the grid leak is the usual one megohm.

The valve used in our experiments was a G. and R. (the wonderful new valve manufactured in Australia) with six volts for the filament, and 22 to 24 volts "B" battery on the plate.

With two stages of audio-frequency, a number of the cheaper kinds of loud speaker attachments were tried, and one of the earpieces from the headphones was attached to a gramaphone horn; in every case, the concerts came in, in sufficient volume to be heard all over the house, and marvellously clear and free from distortion.

The G. and R. Valves were also used in the amplifier, with 30 volts on the plate, at which potential the highest amplification efficiency is obtained.

The full list of materials required is as follows:—

1. A variable condenser of .001 mfd. capacity.
2. A fixed condenser of .0005 mfd.
3. A one-megohm grid leak.
4. A single slide tuner as described.
5. A valve holder.
6. A rheostat, preferably of the vernier kind.
7. A 6-volt "A" Battery.
8. A 30 to 40 volt "B" Battery.
9. A honeycomb coil of 100 turns.
10. Terminals, wire, etc.
11. A "G. & R." valve.

And if the two stages of audio-frequency amplification are to be added:—

12. Two "G. & R." valves.
13. Two valve holders.
14. Two rheostats.
15. Two audio-frequency transformers.

The same "A" and "B" batteries will serve for both detector and amplifier, but the life of the "B" battery will be prolonged if a separate "B" battery is employed for the amplifier.

To begin with, it is best to test out the receiver in the most rough and ready fashion.

A well-shellacked cardboard former is as good as any, and those who desire a neater job than they can do themselves can obtain the 3in. diameter by 4in. long former, wound with 80 turns of No. 22 gauge enamelled wire from any of our advertisers for a few shillings. Two terminals will be required for the inductance, one at the beginning of the winding for the aerial lead, from the aerial condenser, and the other connected to the bar of the slider. The former being four inches long, if the end pieces are a quarter of an inch thick, the slide bar will be 4½ inches long, or 4¾ inches long if the end pieces are three-eighths of an inch in thickness.

In the April "Review," full directions were given on pages twenty and twenty-one for constructing variable condensers, and the experimenter can make up his own .001 variable by following those directions. For the condenser, 22 fixed plates of the standard 3½in. diameter, with 21 moving plates of 3½in. diameter, will be required.

The standard fixed condenser of .0005 mfd. capacity is 2¼ inches long, and is furnished with two eyelet holes for connections. In these holes, two small terminals are secured, or two small switch studs fitted with two nuts each, will do to receive the connecting wires.

A piece of visiting card, 2¼in. by ⅝in., should be cut, and a line in lead pencil drawn right across the centre, from end to end.

The line should be one-eighth of an inch wide, and the lead pencil well rubbed in. A hole should be punched in the card, to correspond with the eyelet holes of the fixed condenser, and the card should be clamped under the terminals, or under one of the nuts of the studs if the latter are employed. The grid condenser and grid leak will then be coupled together, ready for action, and the one-eighth inch wide line or band of pencil marks will, roughly, be of one megohm resistance.

In the January "Review," directions were given for winding honeycomb coils, and the experimenter can construct his own 100 turns coil by consulting the "Review" mentioned.

Having procured the necessary parts, assembling may be proceeded with.

A convenient way to mount the valve is to screw the valve holder and rheostat to a cigar box. The top of the cigar box is usually thicker than the bottom of it, so it is well to use the tiny brads from the bottom of the box to nail up the top, and to knock the bottom out. The box is then stood on its side, and the valve holder is screwed down to the new "top." The rheostat is screwed to one end, the rheostat proper being inside, and the control knob outside, just as if panel mounted. Two terminals at the other end of the box will serve to connect the "A" battery, and a second pair of terminals, connected inside the box, one to the positive "A," and one to the negative "A" terminals will facilitate coupling in the negative "B" battery, without having too many wires on the one terminal outside the cigar box.

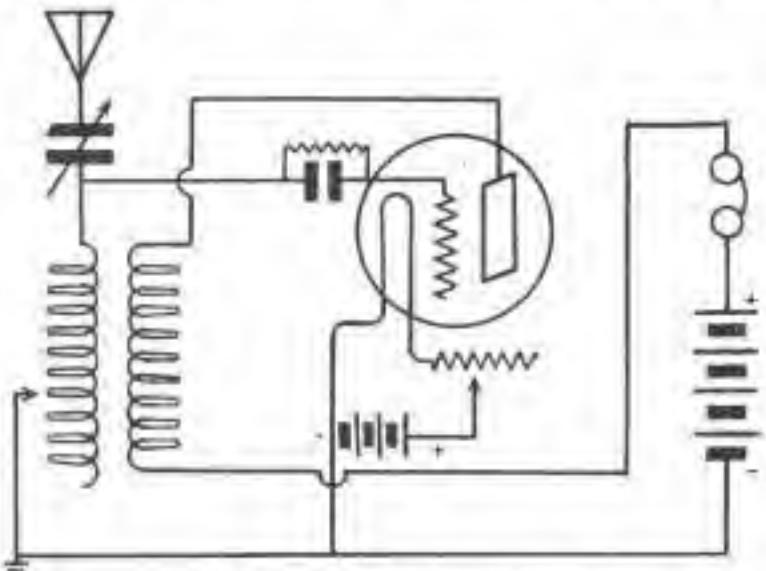
The honeycomb coil of 100 turns should be mounted, and the easiest way to couple it in to the circuit of this receiver is to procure a spare mounting, solder a stiff piece of copper wire to each connecting lug, and join a small size terminal of the "hole" type to each piece of wire. The mounted honeycomb coil is, of course, plugged into the spare mounting just mentioned.

To wire up the set, some of the number 22 enamelled wire will do for all the connections except the "A" battery, which should be a length of black, and a length of red, insulated wire, used in house wiring, and known as "one-eighteen." The lead-in from the aerial is clamped under one terminal of the condenser, and a short piece of wire connects the other condenser terminal and the aerial terminal at the beginning of the single slide inductance.

From the aerial terminal mentioned, another short piece of wire connects with the grid-condenser grid-leak combination, the other side of which is connected to the grid connection on the valve holder. From the plate terminal of the valve holder, a lead is taken to one terminal of the honeycomb coil. The other lead from the honeycomb coil is taken on to one of a pair of terminals, which may be mounted on the cigar box for convenience, and to which the telephones will be attached. The positive lead from the "B" battery will be attached to the other telephone terminal.

If the telephone terminals are mounted on top of the cigar box, the honeycomb coil lead and the positive "B" battery lead may be connected underneath, leaving the terminals free of other wiring to receive the telephone tips. "Hole" type terminals are best for this purpose.

The positive of the "A" battery is connected to the right hand terminal on the outside of the box, and from the inside is carried on to the rheostat, and from there to one of the filament terminals of the valve holder. The negative terminal is similarly connected, and from the inside of the box a lead is taken to the other filament terminal of the valve holder.



The Circuit of the Best Concert Receiver

The valve is now completely coupled up.

To complete the wiring, the negative of the "B" battery is connected to the spare terminal, which is coupled inside the box to the negative of the "A" battery. The coupling is thus negative of "B" battery to the negative of "A" battery. From the terminal where the negative of the "B" battery is joined to the negative of the "A" battery, another lead is taken to earth terminal of the single slide tuner (which, it will be remembered, is connected to the slide bar), and the earth lead is also connected to the last mentioned terminal.

The circuit is now complete.

The best way to couple in the "B" battery is to procure two of the special tie-clip pattern clips, manufactured for electrical connections purposes, and solder one end of a wire to each clip. The dealers are now stocking these clips.

By connecting the free ends of the wires to their respective terminals, the clips are available for clipping to the "B" battery, and permit a variation of the applied potential with a minimum of effort.

If the two stages of audio-frequency amplification are to be added, the valve holders, rheostats and connecting terminals can be mounted on another cigar box. The primary terminals of the first transformer are connected to the telephone terminals of the detector box. One of the secondary terminals of the first transformer is connected to the grid connection of the first amplifying valve, and the other secondary terminal is connected to the negative of the "A" battery.

All four terminals of the first audio-frequency transformer are now connected up.

From the plate connection of the first amplifying valve holder, a lead is connected to one of the primary terminals of the second transformer, and the other primary terminal is connected to the "B" battery positive. One of the terminals on the secondary side of the second transformer is connected to the grid terminal of the second valve holder, and the other secondary side terminal of the transformer is connected to the negative side of the "A" battery.

The plate terminal of the second amplifying valve holder is now connected to a terminal mounted on the end of the box, and a lead from that terminal is taken to one terminal of the loud speaker or telephone ear-piece. The other terminal of the loud speaker or ear-piece is connected to the positive of the "B" battery.

In using cigar boxes for experiments as suggested, the labels should be scraped off, and a coat or so of shellac varnish applied inside and out. A wide-mouthed bottle half-filled with shellac and then filled up with methylated spirits, will be about right for the varnish. Shake up occasionally, and it will be ready for use in about an hour. As it dries almost as soon as it is applied, two or three coats can be given in a very short time. If the varnish is not at hand,

the dry, well-seasoned wood of the cigar box is quite sufficient insulation between the various terminals. In making up the amplifier, four terminals should be screwed on at both ends. A rheostat should be mounted at each end, the control knob of each projecting on the outside. The terminals should be mounted so that they centre three-quarters of an inch from each end corner.

With the open side of the box away from you, the two upper terminals on the left end should connect to the telephone terminals of the detector box on the outside, and inside the amplifier box these two terminals should be connected to the primary terminals of the first transformer, as described. The bottom pair of terminals on the left side should carry the "A" battery positive and negative connections, positive to the right and negative to the left. Inside the amplifier box the positive "A" lead should be taken to the rheostats, and one wire, looped at the first rheostat will serve. One wire, from the negative "A" terminal, also looped at the filament terminal of the first valve holder, and then carried on to the filament terminal of the second valve holder will do.

On the right hand side of the amplifier box, the lower pair of terminals should receive, one, the positive lead from the "B" battery, and then carried on, inside the box to one terminal of the primary of the second transformer; the other lower terminal should be connected outside the box to the negative of "A" battery and inside the box a wire is connected from this right hand lower terminal to a terminal on the secondary side of the second transformer, where it is looped and then carried on to the filament terminal on the secondary side of the first transformer. Of the two terminals on the top at the right hand end of the box, one is to connect the plate of the last amplifying valve to, on the inside, and from the outside, a lead is taken to one terminal of the loud speaker as already mentioned. If the lower terminal, which is connected to the positive of "B" battery, is connected inside the box to the remaining upper terminal, both upper terminals may be readily connected to the two terminals of the loud speaker. Taking a lead from negative "A" battery terminal at one end of the box, to the terminal at the other end, which is connected to the secondaries of the transformers, enables the experimenter to couple in a "C" battery if he so desires, in which case the "C" battery negative is coupled to the terminal serving the transformer secondaries, and the "C" battery positive is joined to the negative of the "A" battery.

To operate the set, turn up the valve, or valves, rather brightly, bring the slider knob to about the centre of the inductance, and the honeycomb coil "tickler" is placed upright and flat against the aerial end of the single slide tuner. Just let the honeycomb coil rest on the table in the position described. With the slider in the position named, on rotating the variable element of the .001 condenser, there will be a sector where the loud double click of oscillation is heard when the aerial wire is tapped. With the inductance all in, this sign of oscillation will obtain during the rotation of practically the whole of the moving part of the condenser. If the double click is not heard when tapping the aerial wire, the set is not working right and connections should be examined.

With the honeycomb coil close to the tuner, signals will be mushy, but moving the coil away an inch or so will clear them, and finally a point will be reached when they are loud and clear.

In receiving telephony, the condenser is rotated slowly until the carrier wave is heard, and about midway between the two high-pitched notes of the wave the music will come in, and it is here that the vernier condenser comes in useful for the fine tuning necessary to obtain the best results. Finally, the music is cleared by taking the honeycomb coil away from the tuner, a fraction of an inch at a time until the maximum result is had, and then the filament of the detector valve is lowered a little to still further clarify.

Having in mind the fact that many beginners read our pages, the fullest possible details have been given for the assembling of this best of radio concert receivers. If those details are carefully followed, experimenters cannot fail to obtain the same pleasing results which we obtained in our experiments. We will be glad to hear from amateurs who make up the set, and to know what success they have had with it. Any further information desired will be freely given.

The receiver is so simply constructed that it is worth the trouble of making it up and keeping it specially for concert reception, even in the case of those experimenters who already have highly efficient all-round receivers.

Whilst very good results may be obtained with any kind of loud speaker attachment, one of the Western Electric type will give still greater results.

A Variometer Concert Receiver

WITH the advent of broadcasted radio concert close at hand, the attention of both amateurs and manufacturers of radio apparatus is being directed in designing concert receiving sets, easy to control and efficient in operation.

One of the most cheaply constructed of these sets is that using variometer control, and it has the merit of not needing any condensers, on account of the fine tuning obtainable with the continuous winding feature of the variometer.

The variometer for the aerial circuit is made up of two cardboard tubes, well varnished with shellac varnish. The outer tube, or stator, is 4 inches in diameter by 3¼ inches long. The inner tube, or rotor, is 3¼ inches in diameter and 1¼ inches long.

Two brass rods, each 3 inches long, 3/16th inch diameter, screwed to clamp up the rotor, and the necessary nuts, will be required to form the "shaft" for the rotor, and two brass bushes with 3/16th inch holes in the centre for each variometer will form the bearings for the rotor shaft.

Half a pound of No. 26 d.c.c. wire will be sufficient for the windings with a little left over.

From the top of the stator tube, at a distance of ⅞in., two holes are punched in the cardboard tube, and the bearing bushes are screwed into position. The holes must, of course, be exactly opposite to each other. Twenty-five turns of the No. 26 wire are wound on the stator, fifteen turns below the bearings, and ten turns above them. The winding is started at the bottom end, starting ⅜in. (three-eighths inch) up. The end of the fifteen turns should be well clear of the bearing bushes.

The wire is then carried on, and the winding of the other ten turns completed. The wire can be secured at each end by punching two small holes in the tube and threading the wire through.

Several inches of wire should be left free at each end for making the necessary connections. The top end, that having the ten turns above the bearing bushes, is the beginning of the variometer.

Two 3/16th inch holes are now punched in the smaller tube and again exactly opposite to each other, through which the rotor shaft will be run.

The small tube is now wound with 25 turns of No. 26 wire, starting ⅜in. (three-eighths inch) from the end, two small holes in the tube permitting the starting of the wire to be secured as before, and several inches of wire are left free at the start. Wind on 12 turns, make a cross-over turn, seeing that it will miss the clamping nuts of the rotor shaft, and continue to wind on the remaining turns on the other half of the small tube. Secure as before, leaving a few inches of free wire for connections.

For mounting the rotor, 16 nuts will be required for each variometer. A piece of the 3in. screwed brass rod

Fig. 1—The Two Valve Receiver.

is passed through each hole in the rotor, and the two nuts are screwed on to the inside of each piece and two nuts on the outside of each piece, thus clamping the rotor firmly to the shaft (the "shaft" is in two pieces, as is obvious), and the end of the rotor winding is scraped clean of insulation, and clamped between the two nuts on the inside of the rotor, and on the side of the rotor which will be opposite to that to which the variometer control handle will be attached. The beginning end of the wiring is cleaned and clamped between the two nuts on the inside of the rotor, on the part of the "shaft" to which the handle will be attached. Before clamping the ends of the rotor winding under their respective pairs of nuts, it will be necessary to pass the shaft pieces through the bushes on the stator, and clamp the wire ends, when the rotor is in position; but first, two extra nuts are placed on each piece of shaft to enable the rotor to be centred and locked.

The next step is to place two of the nuts on the outer side of the shaft pieces, that is outside the stator tube. These should be adjusted so that the rotor may rotate freely. At this point there are two nuts on the shaft pieces, inside the rotor, and four nuts on the outside of the rotor, on each piece of shaft, and two nuts on each shaft piece on the outside of the stator.

The bottom end of the stator winding, that is, the starting end of the winding, is now scraped clean and clamped between another pair of nuts, screwed on to the shaft piece, to which the handle will be attached, and this pair of "terminal" nuts should be fixed at a distance of half an inch from the pair clamping up the rotor to the stator. This wire should be long enough to permit the rotor to be turned round 180 degrees. The "lead-in" of the variometer will be the top of the stator, that is the end with the ten turns on it, and the lead-out will be clamped between two nuts, screwed on to the piece of shaft which is opposite to the handle side.

These wires should be long enough to permit them to be clamped under two terminals on the assembling board to be mentioned presently.

The other variometer is wound and assembled in the same way, but the winding on the stator is 107 turns of No. 26 d.c.c. wire, 81 turns being below the bearing bushes and 26 turns above them.

The rotor of this variometer is wound with 58 turns of the No. 26 d.c.c., 30 turns on one side of the shaft piece, and 28 turns on the other side.

The final act of the construction of the variometers is to cut two pieces of cigar box wood, three inches long by one inch wide, and to bore a hole, either in the centre, or at one end, to allow the handle side shaft piece to be clamped to the handle with a pair of the nuts, one on each side of the wood.

The grid condenser is a fixed one of .0005 mfd. capacity, and the grid leak is of 2 megohms resistance.

In the diagram of Figure 1, two valves are shown. The first valve is one step of variometer tuned radio-frequency, the second valve the detec-

tor valve. If a one-valve set is desired, the lead from the aerial is taken to the grid condenser and grid leak, then on to the grid, and the second variometer lead is joined to the plate terminal of the valve holder; the other lead of the variometer is taken to one of the phone terminals, the other phone terminal being attached to the positive of the "B" battery.

In the diagram of Figure 2, the two valve set of Figure 1 is shown, with the addition of two stages of audio frequency. This circuit may be varied by making the first section a one-valve set, and adding two or three stages of audio-frequency, but the set as shown in the diagram is the ideal one for operating a loud speaker, the one stage of radio-frequency seeming

One rheostat for all the valves may be used as shown in the diagram, but a separate rheostat for all the valves is preferable.

If one rheostat is used, the ordinary rheostat will not do, and a specially designed one to carry the heavy current for four valves must be procured. If, however, the new Cunningham 301A, or the new Radiotron 201A, quarter ampere, amplifying valves are used, one good rheostat will serve.

First screw down all the valve sockets and rheostats, and, from the positive terminal of the "A" battery, run a wire of not less than No. 14 gauge d.c.c., varnished with shellac, to one terminal of all the rheostats. Connect the other terminal of the rheo-

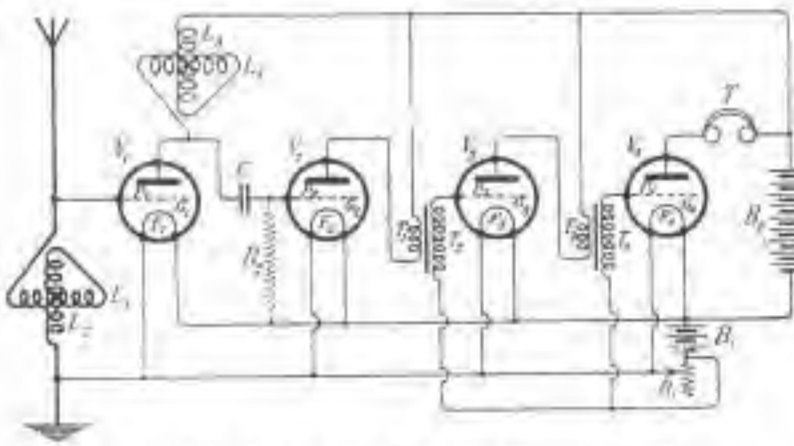


Fig. 2.—Two Stages of Audio-Frequency Added.

to bring in the softer sounds, and so giving to a loud speaker a more correct rendering of the transmission.

In assembling the set, a piece of dry cedar or maple, one-quarter to 3/16in. thick, 30 inches long by 12 inches wide, should be used as an assembly base. This piece of board should have end pieces 12in. x 3in. x 1in. screwed on, on edge, to raise the "set" from the table. Two fairly large terminals should be provided at the left for aerial and earth connection. On the right there should be mounted two pairs of terminals, one pair for the "A" battery leads and one pair for the "B" battery. If a third terminal is added for the "B" battery, to act as a common negative, one terminal can carry a positive lead from, say, 21 volts for the detector, and the other, a positive lead from the 40 to 60 volts tap on the "B" battery for the radio and audio-frequency amplifying valves.

stats to one of the filament terminals of the valve holders. A single wire will do, forming a loop in the wire to attach to the first, second and third rheostats and finishing at the fourth. (That is assuming the four valve set is to be constructed.) Next connect the remaining filament terminals of the valve holders with a similar wire to the negative terminal of the "A" battery.

The "A" battery is one of 6 volts, but an 8 volt one with a terminal at the 6 volts point is better where amplification is employed.

The variometers may be simply stood upright on the board, or they may be secured in position by drilling two small holes in the bottom of the stators, and using switch point studs for bolts, to bend two pieces of brass, half an inch wide, in the centre, so that a right angled bracket is formed, which may then be screwed down to the board, holding the variometers firmly in position.

The aerial lead-in wire is now joined to the aerial terminal, and then on to the terminal of the first variometer (the one with the 25 turns on stator and rotor), and from the same terminal a wire is joined to the grid terminal of the first valve holder. The other terminal of this variometer is connected to the earth lead terminal, and from the same terminal another wire joins on to the negative side of the "A" battery filament terminal of the first valve holder. One terminal of the second variometer is coupled to the plate terminal of the first valve holder, and from the same terminal another wire is connected to the grid condenser, two switch point studs, with two nuts on each, being used as bolts to make the necessary connections. The other end of the grid condenser is then connected to the grid terminal of the second valve holder. The other terminal of the second variometer is carried on to one of a pair of telephone terminals, which are mounted on the front of the board, and well to the right of it. To the same telephone terminal the positive of the "B" battery is connected. A wire now connects the plate of the second valve and the remaining telephone terminal. If the two stages of audio-frequency are to be added, to make up the full four-valve set, the primary terminals of the first audio-frequency transformer are joined to the two telephone terminals, and the secondary terminals of the same transformer are connected, one to the grid of the third valve, and the other to the negative side of the "A" battery. The plate of the third valve is next connected to one terminal of the primary of the second transformer, and the other terminal of the primary is joined to the positive of the "B" battery. One of the secondary terminals is joined to the grid terminal of the last valve holder, and the other secondary terminal to the negative "A" battery as before.

A second pair of telephone terminals is mounted at the extreme right of the board, and the plate terminal of the last valve holder is connected to one of the telephone terminals, and the "B" battery positive to the other. From these telephone terminals, leads may be taken to the loud speaker, or the headpieces can be attached.

Tests on Low Power with Tasmania

By H. KINGSLEY LOVE, Melbourne

SOME 12 or 18 months ago, when the Transpacific Radio Tests were mooted, it was thought in many quarters that the chances were rather remote. Recent tests, which have been successfully carried out by Melbourne experimenters have backed the originators' theory that we have not yet solved the problem of "Greatest distance with minimum power."

In the "Spark" days, it would have been classified as absurd if an experimenter had ventured to express the opinion that a 5 Watt output would have been clearly read in Hobart.

The writer is of the opinion that the experimenter, both in Australia and overseas, has done a great deal to forward the investigation of very low powered transmission.

It can safely be concluded that, on the basis of recent results, the Transpacific Test is sure to be a success.

If this be so, where will it all end? Where do the very feeble waves peter out?

The writer believes that if his deductions are proved correct, and the Transpacific Test accomplished, lower powered transmission to and receipt from the United Kingdom will resolve itself into merely a matter of time.

To be called experimenters, we must be ambitious, even should it border on what we consider to-day to be absurd. It is not what we can do to-day, it is what we shall be able to do to-morrow, that the experimenter must head towards.

There are many who can conclusively prove by figures a theory that low power cannot reach beyond a certain limited distance—but how can we disregard the practice?

Most theories are based on either practice or perhaps even on accident.

The following particulars of the Tasmanian tests which commenced at 9.8 p.m. on 14/3/'23, will do more to help the experimenters' cause than most text books which have been printed to date.

Mr. Ross Hull, of Melbourne, has been the active organiser of the tests, and it is largely due to his efforts that the scheme worked so smoothly from its inception.

The Stations taking part were:—

3 J U—Mr. Ross Hull.
3 B Q—Mr. M. Howden.
3 B D—Mr. Cox.
3 B Y—Mr. Holst.
3 M C—Mr. Newman.
3 A M—Mr. C. Dehrman.
3 B M—Mr. H. K. Love.

Each station was allotted a four letter code, which was used in place of the usual call sign.

The receiving station was 7 A A, Mr. Watkins, Hobart.

The time of commencement was at the conclusion of V I M's Ocean Forecast, and the first station sent from that time until 9.20.

The 2nd station commenced 9.20 and sent till 9.30, then each station 10 mins.

This procedure was followed from the 14th inst. until the 18th.

In order that the tests should be conducted as an experiment of value, the input of each station was taken, and in all cases the transmitters were adjusted so as to keep the input down to 8 watts.

Four of the stations were logged by Mr. Maclurcan in Sydney.

He reports that 3 M. C., whose input was 4 watts or thereabouts and radiation .6, was by far the strongest; while the next strongest was 3 B. Y., whose input was 3 watts and radiation .8.

This goes to prove that low power sets carefully adjusted can do wonders. All seven stations taking part in these tests were successfully copied in Hobart, on a single receiving valve. Apart from the very excellent transmitting records—the reception was a splendid piece of work.

In addition to C. W., telephone was logged from many of the stations and clearly understood.

None of the stations have been operating more than about six weeks, and I consider great credit is due to them for the wonderful results obtained. Doubtless after a little more experimenting, future tests will reveal results even more encouraging.

It will be of interest to intending contestants that an American Amateur Station has been heard on a ship within 100 miles of the Queensland coast.

In the writer's opinion, the Transpacific test will be a great success!

THE ELECTRIC LIGHT MAINS AS AN AERIAL.

THE experiment with the electric mains as an aerial described herein was carried out at Kalamunda, about 12 miles outside Perth, W.A., and is 16 miles from V.I.P. Station. Electric power is brought to Kalamunda from Perth at 20,000 volts and is stepped down to 250 volts at 40 cycles. The receiving set was connected up to the light socket with the usual wooden adaptor, and a condenser placed in series with each line. The condensers were made up of five plates of 3 inches x 4 inches area, with glass dialectric. After passing through the condensers, the incoming signals were passed on to the receiver by joining both leads together at one terminal of a seven plate variable condenser, and a connection taken from the other terminal of the condenser to the aerial connection of the set. The usual earth connection was used.

With an aerial 200 feet long and 30 feet high, signals were always weak, and this may be accounted for by the fact that it was at the bottom of a valley and almost surrounded by hills, which are heavily timbered.

With the receiver connected to the lighting mains, in the manner described, signals came in very strongly and the static was about the same as on the outside aerial. V.I.P. was readable twenty feet from the phones.

A certain amount of a.c. hum was present, but the good signals easily drowned it.

The placing of the variable condenser in the earth lead would probably still further reduce the hum, and it would be well worth trying.

THE LAST WORD IN MICROPHONES.

THE photograph gives a view of a unique device for telephony transmission which is built on entirely new scientific principles.

A high voltage glow discharge takes place continuously between the upper electrode in the inner circle of the illustration, and the lower shielded electrode, at the bottom of the inner circle. The bright portion of the discharge is covered by a cylindrical shield and only the dark portion, known as the "Faraday space," is exposed to the sound waves to be recorded. As these waves pass through this space they control the amount of current flowing in the discharge, and thus modulate the current in perfect conformation with these waves.

Even in the best of microphones so far developed, some of the richness and colour of the musical tones has been lost. The trouble has lain in the diaphragm—a little disc of metal which is supposed to vibrate when sounds are impressed against its surface. It is practically impossible to construct a diaphragm which will respond to extremely low tones and high tones at the same time; every vibrating object has a natural period of vibration, and responds to impulses of this frequency to the exclusion of vibrations which differ to any extent from it.

The inventor has rejected the diaphragm as a pick-up device on account of this inherent incapacity to reproduce intricate sound values. After many months of research, he has evolved the "glow discharge" transmitter. This new device has no natural period and reproduces tones running from a frequency of 60 to 6000 with absolute faithfulness. Any combination of these frequencies, such as are employed in musical instruments are recorded with naturalness and purity.

During continuous tests, the new transmitter has demonstrated its worth and capacity. The principle of the transmitter is that of the impression of the sound waves on high-potential low current discharge between two electrodes, which changes the resistance of the arc column and so controls the electric modulator current. This is a forward step in broadcasting, as music will be transmitted true to life and colourful.

ANOTHER MELBOURNE AMATEUR REPORTS HEARING SYDNEY.

MR. E. H. COX, whose call sign is 3 B.D., reports that the first 400 metre station in Sydney to be heard in Melbourne, was 2 I.X., which station was heard very clearly and in good volume on the night of March 31st by Mr. H. Holst at Caulfield, who was using one stage of tuned radio frequency amplification. The same station was heard by other Melbourne amateurs on the same night, both music and speech coming clearly and in good strength, the carrier wave being surprisingly strong.

The following night two stations were heard, and although their carriers were of good strength, the telephony was audible but unintelligible. As they did not transmit any calls on straight C.W., it was impossible to obtain their call signs. Since then several stations have been heard, 2 F.A. being particularly good on C.W. (or perhaps it might better be called I.C.W.), for the carrier, even at that distance, bears testimony that there is room for improvement in 2.F.A.'s rectifier. (We pass on Mr. Cox's opinion on this point to 2.F.A., for the information of the latter.—Ed.)

Many other carriers are regularly heard, many using one valve only, and the music of 2 I.X. is quite good on one valve. As the phone is very weak by the time it reaches Melbourne, it is desirable that the call signs should be sent on C.W., and a few minutes on the key each night might bring a pleasant surprise to the Sydney amateurs. Mr. Cox, continuing his report, says: "On the night of April 3rd, I called 2.F.A. and pleaded with him to 'cum bk on C.W.', but he was not listening, or, my half amp. of aerial current left the Sydney ether unruffled. However, as things are now going, with seven Melbourne transmitting stations doing serious work, which stations are all logged in Sydney, and the Sydney amateurs coming in at Melbourne very Q.S.A., there does not appear to be any doubt but that two-way communication between Sydney and Melbourne will have become un fait accompli by the time this report appears in print."

Mr. James Malone

CHIEF MANAGER TELEGRAPHS AND WIRELESS

Australia's Leading Radio Engineer

MR. JAMES MALONE joined the Post and Telegraph Department as a telegraph messenger at Lismore, N.S.W., in 1898. In 1900 he was acting as a Relieving Officer. As the result of competitive examination, he was appointed to the Telegraph Engineering Branch, Sydney, in 1906.

From that time on he occupied various engineering positions in the Department, amongst them being Engineer for Sydney and District, Engineer at Goulburn, and later Engineer for Lines, Queensland, which position he held until 1915.

On the outbreak of war he enlisted, and was immediately appointed Instructor in Wireless at the Wireless School, Moore Park, Sydney. When on active service he was placed in charge of all the A.F.C. Wireless activities in France.

He had the honour of being awarded the Military Cross.

After the Armistice he remained in Europe for more than a year, studying European methods in Wireless and other communication engineering subjects; and during a portion of this time he was at the R.A.F. Wireless Experimental Establishment, Biggin Hill, England, and the Signals Experimental Establishment at Woolwich.

Leaving England, he passed on to the United States, where he spent nearly five months acquainting himself, at first hand, with American methods as applied to his profession. He also spent some little time in studying in New Zealand, whose Postal Telegraphic Department is acknowledged to be one of the finest in the world.

On his arrival in Australia, Mr. Malone was appointed Deputy State Engineer, Perth, and shortly afterwards, when the Postmaster-General's Department took back the Radio Service from the Navy Department, he was brought from Perth to take charge of the Radio Service, and held that position until 1922, when the Government commercial communication activities in Wireless were transferred to the Amalgamated Wireless (Australia), Ltd.

During the time he was in charge of the Radio Department he prepared plans for the re-organisation of all the Coastal Stations, and these plans, although approved, were not proceeded with owing to the transfer of activities being made as stated.

At this time he was appointed Controller of Wireless in the Prime Minister's Department, and now holds the position of Chief Manager of Telegraphs and Wireless for the Commonwealth, in the Postmaster-General's Department, and in that position acts as Adviser to the Commonwealth Government on all Wireless matters, and is the responsible officer for the Wireless Act and Regulations.

In 1922 he was Technical Adviser to a Parliamentary Committee on Wireless, which investigated proposals leading to the Agreement between the Commonwealth Government and Amalgamated Wireless, Ltd., and when he was appointed Controller of Wireless he prepared the existing Wireless Telegraphy Regulations.

He is a member of the Institute of Radio Engineers, Member of the Institute of Electrical Engineers, and is a Member of the American Institute of Electrical Engineers.

By experience and qualifications, no one is better fitted than Mr. Malone to hold such a high position as that of Advisory Expert and Chief Manager for the Commonwealth of its Telegraphic and Wireless Communications Department. He has attained his position by sheer ability and energy, and we wish him every success.

An Australian Who Has Made Good

MR. JAMES MALONE

Chief Manager of Telegraphs and Wireless for the Commonwealth

The Armstrong Super-Regenerative Circuit

Article 4

THE latest development of the Armstrong Super-Regenerative Circuit is the construction of a one-valve receiver in which the vario-coupler and its specially-wound secondary are dispensed with in favour of a tuned plate circuit in which a standard variometer is used.

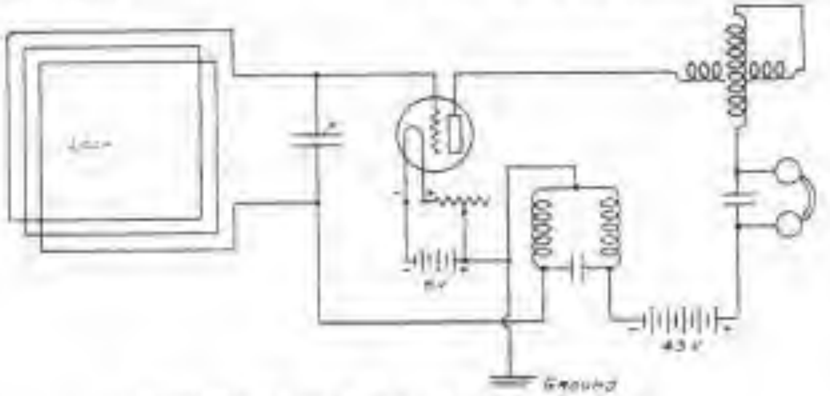


Fig. 1. The Wiring Diagram of the One-Valve Receiver.

The loop is tuned by a vernier variable condenser of .001 mfd. capacity.

The variable condensers across each of the 1500 and 1250 turns honeycomb coils have been replaced by a single fixed condenser of .0015 mfd.

This reduces the variable elements from six to three, the plate variometer, the loop tuning condenser and the filament rheostat, which is also of the vernier type.

The loop is a spirally wound one, the outer turns being two feet long on each of the four sides.

A Western Electric oxide-coated filament valve is said to give the best results in this one valve super-regenerative receiver, and the filament is burned a little brighter than usual.

The 1500 and 1250 turns coils are placed at right angles to each other so that they form a "T", the position of minimum coupling, and they should not be placed too close to the variometer.

The "A" battery is the usual 6 volt one, and the "B" battery maximum is 43 volts.

Figure 1 shows the wiring diagram, and figure 2 gives the lay-out of the various parts. Figure 4 is a back of panel view of the mounted instruments and coils, and it will be noted that long ebonite handles control the moving elements, with the object of over-coming the body capacity effect, which experiments with the Armstrong Super-regenerative circuit prove to be very great.

The range of the receiver is 100 to 400 metres. By using a loop a little larger, and employing a variometer with a higher range, the range of the receiver may be increased to cover the amateur transmission wave length of 440 metres.

There is a slight sacrifice in the total volume of amplification by reducing the control elements to three, but this is more than compensated by the increased facility in adjusting, as the critical or difficult manipulation is done away with, and yet the receiver is capable of marvellous results.

In tuning, the usual shrill whistle is heard when the filament is lit, but it almost disappears when the proper adjustment is found. The loop tuning condenser and the variometer adjustments bear a very definite relation to each other, which is properly indicated by a noisy rattle. The correct adjustment for reception is somewhere in the middle of the noise, and when the right position is found, the noise will stop and the speech or music will come in quite clearly. When the music stops, the noise will commence

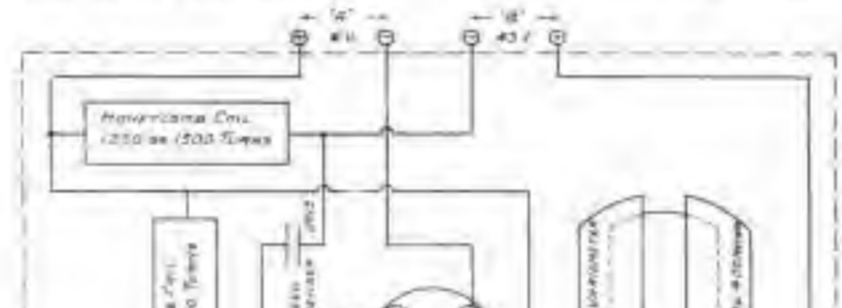


Fig. 2. Plan of the Receiver.

again, but the adjustments should be left alone, as the rattle will cease when the music starts up once more.

The loop should be rotated to various positions until maximum loudness is obtained.

There is no filter circuit, no air core choke, and no grid battery in the circuit of this one valve receiver, and as experimenters who are trying out the Armstrong Super-regenerative Circuit will have all that is necessary on hand—it is only a few moments' work to couple up this receiver and to test what it is capable of. There is no need to wait until the special valve mentioned may be obtained, one of the hard valves used in the general super-regenerative experiments will serve for a test, at least.

Several amateurs have written asking if certain kinds of soft valves may be used in the circuit. Only the hardest of amplifying valves will produce results. Radiotron 201 or Cunningham 301 or the new amplifier, the Cunningham "301 A" are suitable.

There is an old saying that you cannot do better than go to the fountain head for advice or information.

Figure 1 is a photo of Major Armstrong demonstrating his Super-Regenerative Circuit. This photograph effectually settles the question as to what kind of loop should be used, and also the question of the large honeycomb coils and the air choke being inductive-

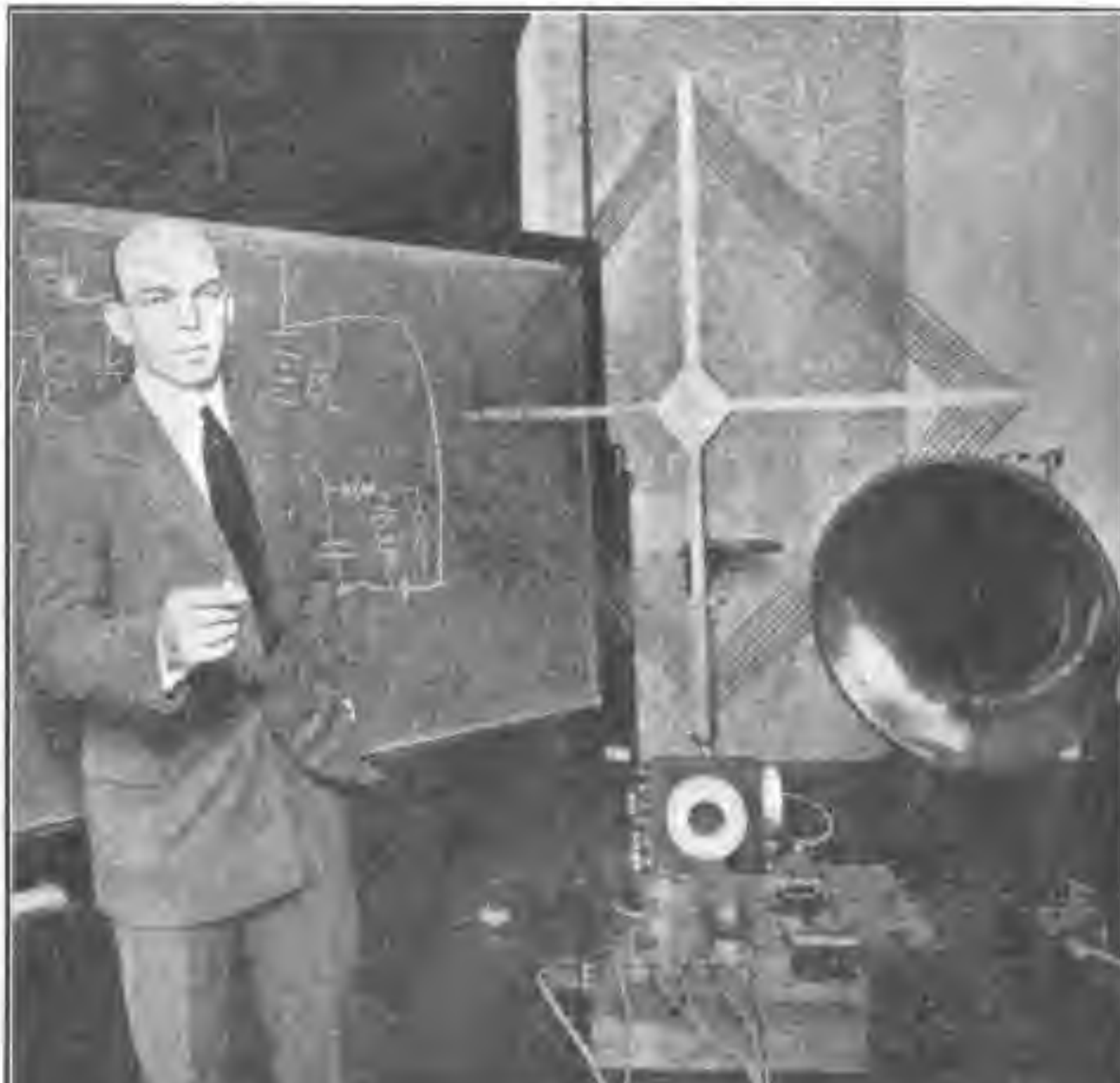


Fig. 1 Major Armstrong Demonstrating his Circuit

ly coupled to the vario-coupler. At the far end of the table is the vario-coupler, the secondary of which was wound with 90 turns of fine wire. The big honeycomb coils are mounted close to the box containing the vario-coupler, to which they are thus inductively coupled. The air core choke of 5 milhenries (nearest honeycomb coil 200 turns) is placed close to the far side of the box, and therefore all these coils are in exactly the same relative positions to each other and the vario-coupler as in the original circuit published in the February number of the "Review."

Major Armstrong says he has just one more thing to "put over" and then he is going to retire for a time and have a well-earned rest travelling in Europe. What the "one thing" is, is indicated by a prophecy he recently made concerning broadcast receivers.

He said that the whole receiver, horn and all will be no larger than the ordinary phonograph, and the current to operate it will be supplied by the electric lighting wires. Instead of the aerial there will be a small coil of wire or a metal rod five or six feet long, something no more conspicuous than the ordinary curtain rod. Unsightly wires and batteries will be banished.

He has an equipment of this kind at his home in Yonkers, which picks up music from distant broadcasting stations in such strength that it can be heard half a mile away.

This new development would seem to be the perfecting and simplifying of the super-regenerative circuit, and it will be interesting to learn what the new receiver really is.

Fig. 7. View of the Instruments assembled.

REVIEW SERVICE.

PEOPLE in the country who require advice or information, or prices or particulars of radio apparatus, receiving sets, etc., will have our assistance if they will write in and let us know their requirements. We will obtain the necessary information for them from our advertisers, and will forward same on.

THE TRANS-PACIFIC TESTS.

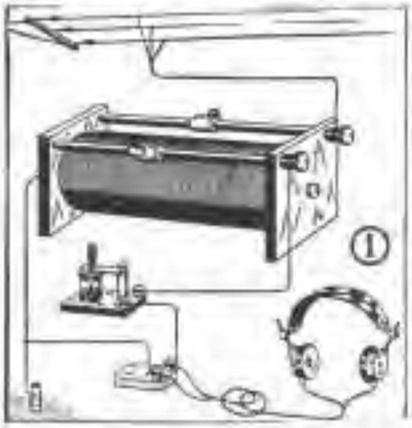
REPORTS to hand to date of this writing indicate that no success has yet been achieved in the Trans-Pacific Tests. We hope that communication will be established before the tests are over, as it will be a most wonderful achievement, and will redound to the credit of Australian amateurs to be able to get American transmission through.

One Subscriber for one Reader will double the "Review" circulation and enable us to increase the number of "Review" pages.

Tips for Fans

A CRYSTAL CIRCUIT EMPLOYING A TWO-SLIDE TUNER.

THE two-slide tuner is a very efficient one, and gives sharper tuning than a tapped inductance.

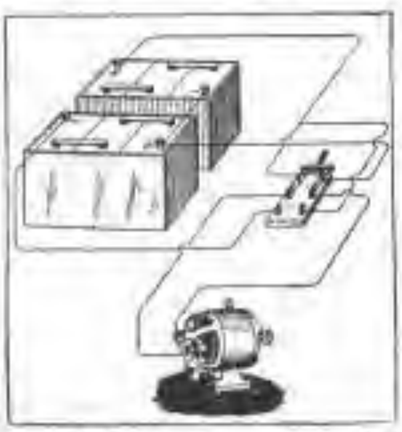


The circuit above shows how it is coupled in with a crystal detector. The detector is of the enclosed type, to prevent dust and dirt lowering the efficiency of the crystal. A tuner of the slide kind should be kept very clean, as the tiny grains of copper rubbed off the wire when moving the sliders up and down are apt to form a continuous path from one turn to another, so short-circuiting them.

* * *

A CHANGE-OVER SWITCH.

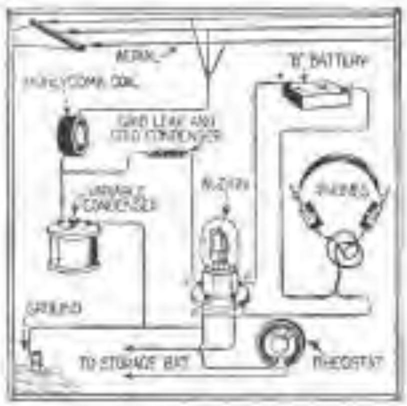
IT is often a puzzling thing to think out the connections of a change-



over switch for using one battery, or two or more in series with each other. Here is the wiring up of a change-over switch which permits one battery or two in series to be coupled to a small motor.

THE SIMPLEST FORM OF VALVE CIRCUIT.

HERE is shown the simplest form of valve circuit in which a single honeycomb coil forms the inductance. A honeycomb coil of 75 turns covers a band of wave lengths ranging from 330 to 1030, and one of that size would therefore be suitable for the reception of amateur concert at 410 to 440 meters and signals on the commercial wave length of 600 meters. A mounted coil should be procured, and an extra mounting attachment to which may be soldered two stout wires for joining on a pair of terminals. The necessary leads can then be connected on to the terminals, and the coil plugged in.



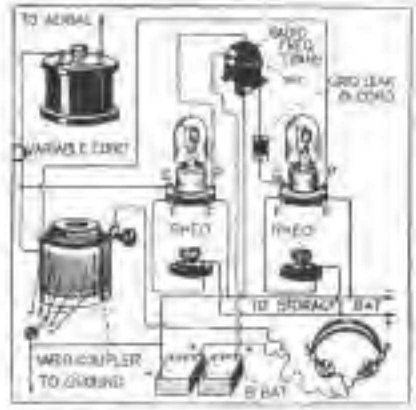
The negative of the "B" battery is joined, through the phones, to the negative of the "A" battery, and then on to earth.

* * *

ONE STAGE OF RADIO FREQUENCY.

SIGNALS too weak to be detected in the ordinary way may be brought in by the addition of one stage (or more) of radio-frequency. Radio-frequency is quite a simple matter now that highly efficient radio-frequency transformers are obtainable, and a post card addressed to any of our advertisers will give you prices and wave lengths covered by radio-frequency transformers in stock.

A stage of radio-frequency may be added to the diagram shown for amplifying crystal signals by omitting the grid leak and condenser and detector valve and coupling the secondary terminals of the radio-frequency transformer, one to the contact wire of the crystal detector, and the other

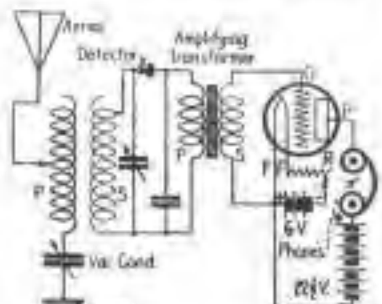


to the primary of the audio-frequency transformer.

* * *

AMPLIFYING CRYSTAL SIGNALS.

WHEN you are seized with "valve fever" don't discard your crystal set, it will give you clearer and sweeter concert reception than any valve. Start with a valve used as an amplifier. This diagram shows you how to couple in the single stage of audio-frequency amplification. If you want to have two stages of amplification, simply couple the phone terminals to the primary terminals of another audio-frequency amplifying transformer, and the secondary terminals to the grid and filament as is shown in



the first valve in the diagram. A third stage can be added in like manner. Recently the Radio Engineer of the New System Telephone Pty., Ltd., at Melbourne, heard Mr. Maclurcan's concert transmitted from Sydney, with a crystal detector and three stages of audio-frequency amplification.

Liquid Rectifiers and Condensers

THE conversion of alternating currents into uni-directional currents of small amperage and at high voltage is most easily effected by means of the electrostatic converter—a combination of rectifiers and condensers. This type of converter is so easily and cheaply constructed that it is surprising it is not more popular, especially among the radio enthusiasts.

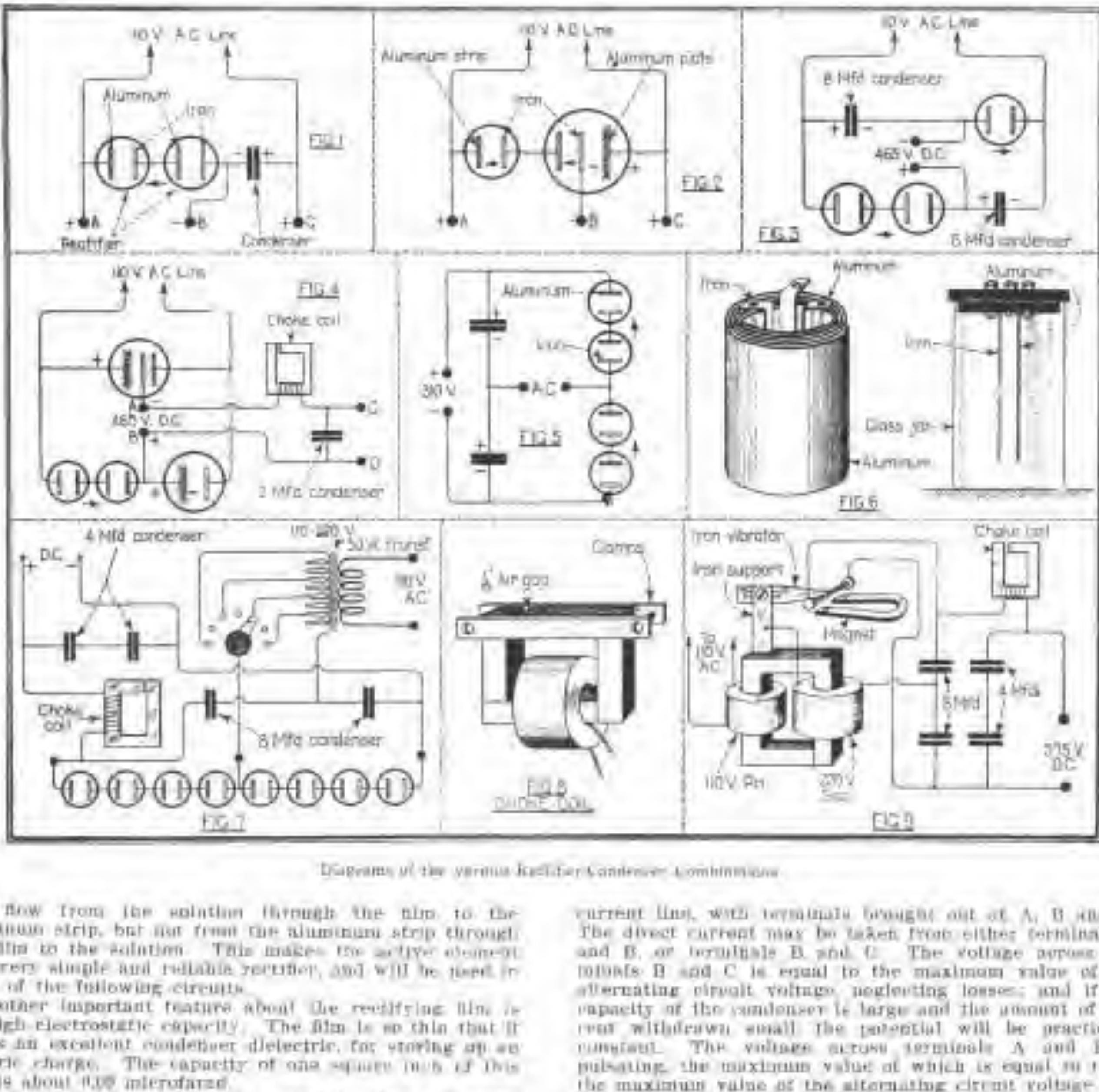
A strip of aluminum and a strip of iron are immersed in a solution of sodium phosphate and connected to an alternating current circuit, a microscopically thin film of oxide forms on the aluminum strip. This film has the peculiar property of allowing current to flow through it in one direction, but not in the other direction. The current will flow from the solution through the film to the aluminum strip, but not from the aluminum strip through the film to the solution. This makes the active element of a very simple and reliable rectifier, and will be used in most of the following circuits.

Another important feature about the rectifying film is its high electrostatic capacity. The film is so thin that it forms an excellent condenser dielectric, for storing up an electric charge. The capacity of one square inch of this film is about 0.09 microfarad.

A simple condenser, of large capacity, that will stand a potential up to 150 volts can be made by immersing an aluminum plate and an iron strip in a solution of sodium phosphate; the aluminum plate constitutes one side of the condenser and the electrolyte constitutes the other side. The iron strip is merely an electric connection to the electrolyte. If the aluminum plate is 6in. by 6in. the condenser will have a capacity of about 6 microfarads. The aluminum plate is connected to the positive side of the line, and the iron strip to the negative side of the line, if used on a D.C. circuit. If the condenser is to be connected to an alternating current line two aluminum plates are used in place of one aluminum plate and one iron strip.

Figure 1 shows the simplest type of electrostatic converter. This converter consists of a rectifier and a condenser, and they are connected in series to an alternating current line, with terminals brought out at A, B and C. The direct current may be taken from either terminals A and B, or terminals B and C. The voltage across terminals B and C is equal to the maximum value of the alternating circuit voltage, neglecting losses; and if the capacity of the condenser is large and the amount of current withdrawn small the potential will be practically constant. The voltage across terminals A and B is pulsating, the maximum value of which is equal to twice the maximum value of the alternating circuit voltage, and the minimum value is equal to zero.

The action of this converter may be explained as follows: Suppose the converter is connected to a 110 volt A.C. line, and the current of the first half cycle flows down

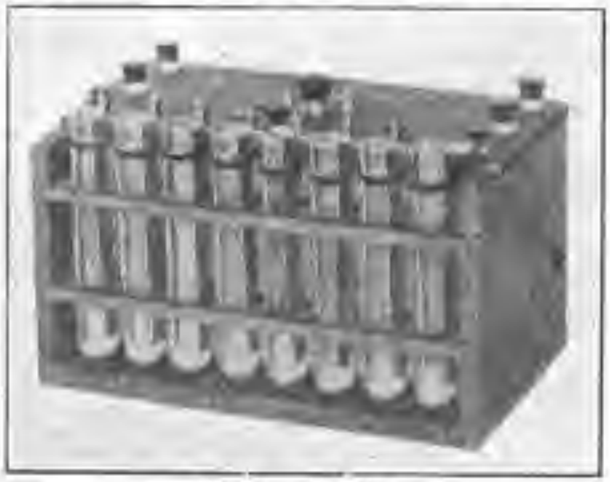


Diagrams of the various Rectifier-Condenser Combinations

the right hand wire. This will charge the condenser to the maximum value of the A.C. voltage, which in this case is 110 x $\sqrt{2}$ or 155 volts. The current of the next half cycle flows down the left-hand wire, but this current cannot flow through the rectifier from the solution to the aluminium, opposite the direction indicated by the arrow, so the current flows from terminal A, through the external circuit to terminal B, and then through the condenser to the other side of the A.C. line. Therefore the condenser, which is charged to 155 volts, is discharged through the external circuit in series with the A.C. line, whose maximum voltage is 155, so that at every other half-cycle the voltage across the terminals A and B is 2 X 155, or 310 volts. The polarity of the terminals will be as indicated.

The actual D.C. voltage is about 87 per cent. of the theoretical value; the losses are due to the resistance of the electrolyte in the rectifiers, and to the current leakage through the rectifiers, as the oxide film is not a perfect insulator.

The aluminum and iron strips of the rectifier are each ½in. by 6in. long. The solution is made by dissolving sodium phosphate in hot water, after which the solution



The Assembled Unit.

is allowed to cool before using. The sodium phosphate may be obtained from any drug store. The rectifier will stand from 150 to 175 volts without breaking down, and as the voltage across terminals A and B is 310, it will be necessary to use two rectifiers in series. The rectifiers may be made up similar to the rectifiers shown in the photograph.

The condenser should have a capacity of several microfarads. Four, two microfarad paper telephone condensers connected in parallel will be sufficient when the current withdrawn is small.

The converter is to be connected to the alternating current line in series with a 110 volt lamp. At first the lamp will light up brightly, and as the rectifying film forms on the aluminum electrodes the lamp will gradually go out.

The converter shown in Figure 2 will give the very same D.C. voltage as that of Figure 1, and the action is identical. The only difference is that instead of using paper condensers advantage is taken of the electrostatic capacity of the rectifier itself for storing up the charge. This type of converter is very cheaply constructed. The small rectifier is made similar to the rectifiers in Figure 1. The other rectifier and electrolytic condenser are combined in one unit and made as shown in Figure 6. They consist of a strip of iron and a strip of aluminium, each ½in by 6in. long, which form the rectifier, and an aluminum plate which forms one side of the condenser of which the solution is the other side—the oxide film acting as the dielectric. An aluminum plate 6in. by 24in. will give a capacity of about 26 microfarads. This plate may be wound in a spiral, as shown in Figure 6.

The converter shown in Figure 3 will give a D.C. voltage equal to three times the maximum value of the A.C. voltage, neglecting losses. This converter is very simple. When connected to a 110 volt A.C. circuit only three small electrolytic rectifiers and two sets of paper telephone condensers will be required. The D.C. voltage will be 3×155, or 465, and will be slightly pulsating, but may be smoothed out or filtered by means of a condenser and a choke coil as shown in Figure 4.

A glance at the diagram will show that one-half cycle of the alternating current wave will charge both sets of condensers in parallel, to the maximum value of the A.C. voltage. The two sets of condensers then discharge through the external circuit in series with each other and in series with the next half-cycle of the alternating current wave, so that the voltage at the D.C. terminals will be three times the maximum value of the A.C. voltage.

Figure 4 is substantially the same as Figure 3, except that electrolytic condensers are used in place of paper condensers. This converter requires one rectifier and condenser made up according to Figure 6, one condenser made up like Figure 6 but without the aluminum strip, and two small rectifiers. The choke coil and paper condenser smooth out the resulting pulsations, thus making the D.C. voltage constant for use on power amplifiers or radio telephone transmitting sets. The design of the choke coil will be taken up later.

The circuit in Figure 5 will give a D.C. voltage of twice the maximum value of the A.C. voltage. For use on a 110 volt line this converter will require four electrolytic rectifiers and two sets of paper condensers. Electrolytic condensers cannot be conveniently used on this circuit. One-half cycle of the A.C. wave charges the other set of condensers. The two sets of condensers discharge in series through the external circuit, thus doubling the voltage.

Figure 7 is a complete wiring diagram of the converter shown in the photograph. This converter was constructed by the writer and used for amplifying radio broadcast programmes. The rectifier is made up of aluminum and block tin strips in a solution of sodium phosphate contained in a 1in. by 6in. test tube. Eight of these rectifiers are used. A layer of oil on the surface of the electrolyte prevents it from evaporating.

The 110 volt line is connected to the primary of a 110-220 volt transformer. The secondary of this transformer has four taps giving voltage variations ranging from 110 to 220 volts. The secondary is connected to the rectifiers and paper condensers so as to double the voltage by using the same circuit as Figure 5. It is then connected through a choke coil to the D.C. terminals. Across the D.C. terminals are connected two sets of paper condensers for filtering purposes. These condensers are connected in series so as to reduce the voltage across each condenser, and thus prevent the condensers from being punctured. The D.C. voltage is adjustable from 300 to 600 volts, by means of the taps on the transformer. The potential is so constant that it is impossible to hear any A.C. hum in the loud talker when used for amplifying purposes.

The core of the transformer is made up of laminated transformer iron and has a cross-sectional area of 1¼in. by 1¼in., or 1.56 square inches. The outside dimensions of the finished core are 5in. x 4½in. The primary winding comprises 450 turns of No. 24 B. & S. enamelled magnet wire wound on one leg of the core. The secondary winding comprises 900 turns of No. 26 enamelled magnet wire wound on the other leg of the core. Taps are brought out of this winding at 450 turns, 600 turns, 750 turns, and the end tap at 900 turns. These taps connect to the tap switch as shown; the dead contact points are placed between each live contact point, so that the switch lever will not short-circuit a portion of the secondary winding when moving from one contact point to the other.

The design of the choke coil is very simple. It consists of a coil of wire wound on an iron core as shown at Figure 8. The core is made up of laminated transformer iron, and has an air gap in the magnetic circuit. The function of the air gap is to increase the reluctance of the magnetic circuit. The function of the air gap is to increase the reluctance of the magnetic circuit so that the iron will not become saturated, thus destroying its magnetic

quality. The inductance of the choke coil should be at least 1½ henries. The choke coil is designed according to the following formula, which is close enough for all practical purposes:—

$$L = \frac{3.19 n^2}{10^8 R}$$

L = inductance in henries
n = number of turns in the coil

$R = \frac{l}{a}$, where l = length of air gap in inches, and a = area of air gap in square inches.

R is the reluctance of the air gap. The reluctance of the iron is so small as compared with that of the air gap that it will be omitted here. If we use a core having a cross-sectional area of ½in. × ½in., or 0.25 square inches, and a 1/16in. air gap, 1/16 ÷ 0.25 = 0.25. Substituting 0.25 for R, and 1½ for L, in our formula, we have:—

$$1\tfrac{1}{2} = \frac{3.19 n^2}{10^8 \times 0.25}$$

Solving we get 3322 turns as the value of n, which is the number of turns required in the coil to give an inductance of 1½ henries. No. 36 B. & S. copper wire will do for this coil.

An electrostatic converter employing a step-up transformer and magnetic rectifier is shown in Figure 9. This type of converter will deliver a higher amperage than the converters described above, and occupies less space. It has the disadvantage that the magnetic rectifier is not quiet in operation and requires more attention than the electrolytic rectifiers.

The connections are the same as those of Figure 7, the potential of the transformer secondary being doubled by means of the rectifier and condensers. A tuned iron vibrator carrying silver contacts is magnetically connected to the transformer core as shown. This vibrates in front of a permanent magnet and makes contact with two adjusting screws. The vibrator is slotted so that its vibrating length can be adjusted in order to accurately tune it to the frequency of the alternating current.

This converter was successfully used by the writer for operating a 10 watt radio telephone transmitter. The hum was practically eliminated by means of the choke coil and condensers.

It should be remembered that one side of the alternating current line is grounded, and if any of the above circuits which do not employ a step-up transformer are used for radio or other purposes, which have a ground connection of their own, a short circuit is apt to result. This difficulty may be overcome in radio sets by connecting small fixed mica condensers in series with the radio ground lead.

Faulty Amplification

FAULTY audio-frequency amplification on weak signals, particularly on the first stage, is a common complaint. To begin with, the same degree of amplification should not be expected on weak and strong signals. That is, if with a near-by station the first step gives an audibility amplification of twenty times, it will give less amplification, possibly only doubling the signal strength of a distant transmitter. This is due to the fact that the output of a tube does not vary directly with the applied E. M. F., but more approximately with its square. Also, throwing in amplifying apparatus appreciably alters the receiving conditions of the entire set, which, in the case of very weak signals, may render them inaudible. Therefore, when tuning is done on the detector, as is often the procedure, the set should be slightly retuned when the amplifier is plugged in, especially on the adjustments determining regeneration.

Probably the most common cause of such amplification difficulties lies in the failure to include a small .005 mfd. telephone shunt condenser across the primary of the first step. It is once more the problem of reducing the positive reactance in a radio circuit. The inductance of an audio-frequency amplifying transformer is made very high (by the soft iron core) in order to secure a transfer of audio-frequency energy. The reactance is therefore much greater than that of a telephone receiver winding, which combined with resistance (the whole being termed "impedance") obstructs the passage of the plate current that varies, in part, at radio frequency. It goes without saying that the shunt condenser is particularly necessary on weak signals; but in many receiving sets it is likewise desirable with near-by stations, as full regeneration can seldom be effected without it.

A capacity for this purpose is easily built up of two pieces of waxed paper, two inches by six inches, and two strips of tinfoil one and a half inches by five. The paper and foil are laid in alternate layers and then rolled into a neat cigarette-like bundle. Leads may be soldered to the tinfoil if it is sufficiently heavy, otherwise connections are more simply made by inserting flexible lighting cord, the individual wires of which have been separated, fanlike, between the foil and the paper before the condenser is rolled. To prevent the leads from pulling out, the wires should be bent back, over the body of the condenser, and the whole taped into a compact unit.

Many instances of faulty amplification are due to transformer and tube troubles, and the experimenter should always make tests to determine just where the difficulty lies. If transposing the tubes gives no change in audibility it is safe to assume, with the "B" batteries in good condition, that the fault is within the cabinet itself. The jacks should be examined to determine whether they are opening and closing the circuit properly.

The leads from the transformer windings often corrode during hot and humid weather and break at the joining with the hairlike windings. A break in the primary will generally result in an uncontrollable howling accompanied by a total loss in amplification. A break in the secondary gives no signals, except in the last step where they may be heard much fainter than on the detector alone. Induction from the electric light wiring is also very noticeable.

When experimentation indicates transformer trouble, the windings should be tested for an open circuit with a flashlight battery and a pair of phones. A loud click indicates a perfect circuit, contrasting with the barely perceptible scratch when it is faulty.

As before mentioned, the majority of breaks occur where the heavier leads are soldered to the thin wire of the windings. When such a break exists at the outer terminal of the secondary, as will be shown by inspection, it may easily resoldered after removing the insulating layer of empire cloth.

An Amateur Wireless Station of the Early Days

THE accompanying photograph is that of an amateur wireless station of pre-war days. It was erected by Mr. Raymond Cottam Allsop, now Radio Engineer to the New System Wireless Co.

The receiving instruments consisted of a loose-coupler and loading coil, aerial tuning condenser, secondary tuning condenser, perikon detector and other crystal detectors. Iron pyrites, silicon and galena were his favourites, but says that his best work was done with galena. He used to tune in Macquarie Islands, all the coast stations, and the incoming shipping.

For transmitting, a 3 kilowatt alternator was used, which was driven by a 5 h.p. motor, using City Council current supply. The transformer stepped up the current to 20,000 volts.

The transmitting condensers were of the Leyden jar type, and the inductance was the usual helix.

The spark gap embodied a patent invented by the Shaw Wireless Company, of Randwick. This was a stream of compressed air, conducted through one of the electrodes, which was hollowed for the purpose. This stream of air, blown through the centre of the spark, drove off the ionised gases, and so made for a more even spark discharge. The air was compressed in a Kellogg 4-cylinder pump. The spark gap and gear can be seen on the right of the photo.

Mr. Allsop's Pre-War Days Transmitting and Receiving Sets

Under the table is a small stand-by transmitting set, having a two-inch spark coil, for spark discharge purposes.

With the transmitting set, Mr. Allsop has been picked up in the Great Australian Bight, a wonderful amateur achievement in those days.

In 1910, he had a Lodge-Muirhead collecter, with a Morse Tape Machine, as part of his receiving equipment.

This set was housed at his home at Barker Street, Randwick, New South Wales.

ELECTRICITY HOUSE

MR. J. S. MARKS, the popular manager of Electricity House, 387 George Street, Sydney, has just completed a four-valve set for his own use at home, where neighbors are entertained from time to time with radio concerts. The set is equipped with three stages of audio-frequency amplification, and it covers all wave lengths up to 25,000 metres. A feature of the set is that in the primary circuit an impedance is placed in series, consisting of 40 turns of No. 30 gauge wire wound upon an iron core, ½in. in diameter and 1in. long. This addition prevents the set re-radiating, and whilst it cuts down strong signals a little, a not undesirable quality, it does not affect weak ones. It does not reduce the volume of radio concert reception in the slightest.

Mr. Marks has also just completed a transmitting set, with which he will send out test matter on 250 metres. In the transmission, two valves are employed, both as oscillators and with grid modulation. Provision has been made for using the set for I. C. W. and C. W. signals. The power used will be 10 watts, the A.C. current being transferred up to 350 volts. The rectifiers are Kenotron Valves, the usual chokes and condensers smoothing out the hum.

Every possible requirement of the experimenter can be met at Electricity House, where a large stock of all wireless sets and parts is carried.

AN ENTERPRISING DENTIST.

MR. SPENCER NOLAN, the well known dentist, of Oxford Street, Sydney, N.S.W., is one of the leading lights of the newly formed Wentworth Radio Club, and he is nothing if not thorough. He has become one of the most enthusiastic of radio fans, and conceived the idea that his numerous friends and clientele would be pleased to hear what concert reception was like. His business premises being so centrally situated, he decided that he would give a radio demonstration there if possible. But what about an aerial? He consulted his wireless friend, Mr. Keogh, the radio engineer in charge of Messrs. Grace Bros., George Street West, Radio Department. "Leave that to me," said Mr. Keogh, "and don't ask any questions."

When the day of the demonstration arrived, Mr. Keogh was there with a radio-audio-frequency receiver, a Magnavox loud speaker, and a cunning little arrangement made up of two .001 fixed condensers, some connecting flex, and a plug. Taking out one of the electric globes, he plugged in the condenser arrangement, switched on his "A" and "B" batteries, and soon had beautifully clear music and song filling the rooms, much to the astonishment of the big crowd present, who were astounded to hear concert items "extracted" from the electric light wires. By arrangement, Mr. H. C. Marsden, the popular President of the Metropolitan Radio Club, transmitted the necessary music, etc., for the test, and he was highly complimented on his successful transmission, the music and songs coming in with great volume, with fine modulation and perfect freedom from extraneous noises.

We take the opportunity to compliment Mr. Nolan, Mr. Keogh, and Mr. Marsden on their initiative and the enthusiasm which prompted them to give the public an opportunity of listening to radio concert, and so helping to popularise this wonderful new phase of science.

How to Begin: By an Amateur for Amateurs

Article 5

IN this article I propose to detail my experiences of entering upon the "valve stage" of amateur experimentation. Having exploited to my satisfaction the possibilities of the crystal, as set forth in my preceding articles, I was ready for the next step forward.

A "valve" is somewhat of a curiosity to a beginner; you see a glass bulb, with some metal stuff inside of it, and it has four bits of thick wire sticking out of the bottom end. The radio shopman sticks two of the bits of wire on a flashlight battery, a little lamp lights up, and the man grunts, "She's all right," you smile acquiescence, and the man says: "Now what about a rheostat?" You ask him "whatostat?" and he proceeds to explain that a rheostat is a coiled resistance wire, with a handle that enables you to use the whole of the resistance or any part of it. It appeared that the particular kind of wire used on the rheostat offered "resistance" to the passage of an electrical current, the more wire used the more "resistance," so that the little bulb could receive a varying current of electricity according to whether one wanted to light it up brightly or dimly. It was further explained to me that it was dangerous to light the bulb too brightly as it might burn out, and that it would, perhaps, be found that the valve performed at its best when it was burned quite dimly—hence the rheostat.

It required a "valve holder," just as an ordinary bulb requires a socket. In the electric lamp socket, however, there are only two contacts, and I knew enough about electricity to know that there must be two contacts in an electric light socket as, to light the filament in the lamp, an electrical current must be completed. That is, that from the power house, one wire goes out to one contact on the lamp and the other contact presses against another wire which goes back to the power house, thus completing the "rounds" or circuit, as they call it.

In the "valve holder" there are four contacts, the four little bits of stiff wire I have already mentioned. Two of these were used by the shopman when he tried the valve on the flash lamp battery; these lit the wire or filament, as it was called, but what about the other two? These were for the "grid" and the "plate," I was informed. The "plate" was a sort of sheath around the filament that lit up, and it appears that the "grid" is a network of wire that surrounds the filament inside the plate or sheath. It puzzled me to reason out how the shopman could talk so glibly of plate "circuits" and grid "circuits" when there was only one contact for each. He went on to tell me that the current from the aerial wires is brought by suitable wire connections to the grid of a valve, and that the grid is always bathed, as it were, in a stream of electrons, tiny particles of electricity, flowing from the filament to the plate when the plate has the positive terminal of a battery connected to it. That this stream of electrons, steadily flowing from the lighted filament, through the grid to the plate, produced no effect in the headphones until the ether waves began to strike the aerial wires.

When the ether waves struck the aerial wires, they were brought down by the lead-in wires to the grid, and as the current used in wireless is alternating current, the grid was thus made first positive and then negative. When the grid was in a negative condition, practically no electrons would flow to the plate, as the same kind of electricity on two contact points simply hate each other and won't lend one another a helping hand at all. But when the grid is in a positive condition, then it beats the Boy Scouts to a cinder, for it does a good turn, not once a day, but a million or more times a second, and helps the poor little negative electrons to flow merrily on to the plate where they might be said to be received with open arms. As all good Boy Scouts know, one cannot do a good turn without receiving some good in return, and as the good little grid, with its tiny and feeble little bits of positive current helps the electrons on their way, they are kind in return and carry the feeble positive bits to the plate where they meet the strong current of the plate battery, and are so pleased and delighted that they spread themselves out all amongst the flowing electrons to such an extent, that if a powerful station is sending, these once feeble grid pulsations of current sound in the headphones like pandemonium let loose.

Now I understood how the one-contact elements, the grid and the plate, completed their circuits.

I had learned by my experience with the crystal detector that the alternating current as it comes to the aerial, will not give audible sounds in the headphones for the reason that the diaphragm in the earpieces is pulled up and down too rapidly. Having now learned that it was only the positive half of the alternating current wave that the grid helped on to the plate, I could not see how it was that the valve functioned as a detector, and how it only permitted the one-direction current to flow which is necessary to enable the ear-pieces to give audible sounds.

The next articles I had to buy were a grid condenser and a grid leak. The grid condenser was of the "fixed" kind and its function was to aid the valve in acting as a detector. In it the incoming signals were stacked up, so to speak, and leaked out to the valve at a much slower rate than they came in, thus aiding the valve in getting through to the phones, a current of audible frequency. The grid leak was a little affair with an ebonite base, two brass clips and a small rod of red fibre, down the centre of which a slot was cut. I was told that if I rubbed this slot with an ordinary lead pencil, running the

pencil marks right on to the brass contacts at the ends, some of the tiny negative electrons would leak away from the valve, when too many of them were crowding the grid. The grid seemingly believes in the old adage "that enough is as good as a crowd," and it refuses to work properly when it is overcrowded with the negative electrons. It appears that the electrons are much like a swarm of bees, clustering about the entrance to a hive. The bees, who are already working the hive, want to go in and out about their business, and the swarm made it difficult for them to do so, therefore when the kind farmer came along and found them a hive of their own, the hive bees could again stick up their motto, "Business as usual." Just as the bees clustered about the hive, the negative electrons cluster on the grid and hang on to each other and the grid until they choke things up.

Then the grid leak comes into play. The pencil line is not a very robust sort of "bridge" but it is quite sufficient to allow the superfluous electrons to "leak" away to the other side of the grid circuit, and so relieve the grid of its congestion of electrons. The pencil line may vary from one-thirty-second of an inch to one-eighth of an inch in width, and the right width is found by experiment, the volume of signals received determining which is the best width to produce the greatest sound. Since I bought my grid leak I have learned that there are variable grid leaks to be obtained, which facilitate the finding of the right amount of resistance for the valve being used, by turning a little handle.

To complete my valve outfit, I needed an "A" battery, which was an ordinary storage battery or accumulator of 6 volts pressure, and a "B" battery, which was made up of a number of small dry cells used in the flash light batteries. The voltage of this battery was 42. The "A" battery was to light up the filament in the valve and the "B" battery was to give the necessary positive current to the plate, as already mentioned.

As I had used a honeycomb coil stand and two coils for my crystal detector, I only had to buy another coil or so to be complete for the valve circuit, as far as the inductances were concerned.

I had my two .001 variable condensers, also on hand, so away off home I went, full of anticipation of the joys to come by being the possessor of a real live valve outfit!

I read up all the circuits I could lay my hands on, and presently came upon one described as a "standard three-coil circuit."

Following the directions carefully, I first placed a 75 turn honeycomb coil in the holder on the left of my stand, for the "primary," a 50 turns coil in the middle, fixed holder, for the "secondary," and a 35 turns coil in the right hand holder for the "tickler."

On the back of the stand were a pair of terminals corresponding with each coil holder.

On one of the terminals of a .001 variable condenser, I joined the aerial-lead-in wire. From the other terminal of the condenser, I joined a short piece of No. 22 gauge wire to one of the primary coil terminals, taking care to scrape off the insulation to give good contact. I connected the earth wire to the other primary coil terminal, and I had my aerial circuit all complete. The fixed grid condenser has two eyelet holes in it, and in these I fixed two small terminals. Before tightening up the nuts underneath the terminals, I attached two short pieces of wire to the grid leak, one at each end, and clamped the other ends of these wires, one under each terminal nut. The grid leak was thus in "shunt" or parallel with the condenser. From one of the secondary coil terminals I connected another short piece of wire to one terminal of a .001 mfd condenser, and from the other terminal of the secondary coil I connected a similar short piece of wire to the other terminal of the same condenser. This condenser was then in "shunt" or "parallel" with the secondary coil.

From the fixed plate terminal of the same condenser I took a short wire connection to one of the terminals on the grid condenser. The other end of the grid condenser I left open for the time being.

The coil remaining to be joined up was the tickler coil.

On a piece of dry board, a quarter of an inch thick, I screwed down my moulded valve holder, and also the rheostat. I next inserted two terminals for the "A" battery wires. From one of the "A" battery terminals I connected a wire to one terminal of the rheostat, and from the other terminal of the rheostat I ran a wire to one of the terminals marked "F" on the holder.

I then connected the other (negative) terminal of the "A" battery and the other terminal marked "F" on the valve holder.

That made my circuit complete for lighting the filament with the rheostat in "series" with the battery and valve holder connection. That disposed of the lighting up problem. Two terminals on the valve holder were still unconnected, and I proceeded to join the unconnected terminal of the grid condenser with the terminal on the valve holder marked "G" (for "grid"). Next, I mounted on my board a pair of terminals for the purpose of attaching the headphones. I then connected one of the terminals of the "tickler" coil to the terminal on the valve holder marked "P" (plate), and from the other terminal of the tickler coil I ran a wire to one of the telephone terminals.

Both the tickler coil terminals were now connected up. To complete my "set" ready for operation I still had to couple in the "B" battery. I soldered a wire to the negative terminal of the "B" battery and joined up that wire at the positive terminal of the "A" battery. As I might want to "explore" with the positive side of the "B" battery, I soldered a piece of wire to an ordinary tie-clip, and attached the other end of the wire to the telephone terminal remaining unconnected. Clamping the telephone cord tips under these terminals I was now ready to "listen in."

The Electron and High Frequency Currents

IN order to understand the abstruse laws and principles exemplified in the production and application of High Frequency currents, it is absolutely essential that the student obtain a clear comprehension of the fundamental processes which form the basis of all electrical phenomena, and to this end a brief summary of the simpler facts of electrophysics in the light of recent discovery will now be given.

Electrical phenomena result, primarily, from the motion of electrons, either in a free state, or united into groups, called atoms. Every atom of every molecule is so constituted that it may be made to give up, to take in one or more electrons. Atoms of Monad elements, if base, or metallic, readily give up a single electron, the remainder constituting a positive ion. Dyad or Triad atoms give out—respectively, two, and three electrons, when they become ions.

Acid forming elements do not really give up electrons, but each atom attaches to itself an electron, and in this manner becomes a negative ion.

Chemical action results from—or consists in—the union between negative and positive ions, to form neutral molecules, called salts.

An electron is a unit charge of negative electricity. Neutral atoms consist of one or more thousands of electrons held in equilibrium in a sphere of positive electricity. There is no such thing as a "positive electron," that is, an isolated unit of positive electricity, capable of existing in a free condition, as in the case of the negative electron. Positive charges, therefore, are found only in association with atoms, and the unit of positive electricity is an atom which has temporarily parted with one of its component electrons; it is, in other words, a positive ion.

The various forms of electrical phenomena may be classed under the following heads:

(1) Magnetism.—Which results from the unequal distribution of electrons in a mass of steel or iron.

(2) "Static" Effects.—Or conditions of electrical "charge," which result from the addition, or withdrawal of electrons from a neutral mass of matter. The temporary addition of electrons to such a mass renders it "negatively charged;" the withdrawal of electrons results in a "positive charge." (The attention of the student is called to the fact that these definitions are the exact reverse of those taught before the advent of the "Electron Theory.")

(3) "Dynamic," or "Kinetic" Effects.—Including the various phenomena of "Electrical Currents." These may be divided into: (a) Currents flowing through solid conductors (such as copper wires), in which the electrons are passed along from atom to atom. (b) "Electrolytic" Currents, which accompany chemical action in solutions, in which the charges move as "Ions"—the electrons being attached, rather than free as in (a). (c) Electrical discharges in air at ordinary pressures, "Electric Sparks," in other words, which consist of sudden, or momentary surges or discharges, in which both ions and electrons are projected across an air space separating two conductors. (d) Electrical currents in gases at extremely low pressures: these consist almost wholly of Streams of Free Electrons, moving with great speed from the "Cathode" (or negative electrode) to the "Anode" (or positive electrode) of a highly exhausted glass bulb, which is called a "Crookes Tube." The "Streams of Electrons" just mentioned are called "Cathode Rays."

MAGNETISM

Magnetism, while usually treated as an electrical phenomenon, has remained a puzzle to physicists up to the present time. The electron theory, which has done so much to dispel the confusion in the minds of students regarding the fundamental nature of electricity, has been of great assistance in explaining the phenomena of magnetism, and electro-magnetic induction. In a bar of pure iron, or soft steel, magnetism may be temporarily induced by the passage of a current of electricity through a spiral coil of wire surrounding it. As has been stated, an electric current involves the passage of electrons through the circuit from the negative to the positive pole. In the spiral coil of wire wound round the bar of soft steel or iron, streams of electrons are flowing round and round the latter in a gradually ascending spiral path. Each electron may be regarded as a moving magnet attracting electrons in the bar, which consequently move through a spiral path, in the superficial layers of iron, corresponding to the number of turns in the coil. The streams of electrons rushing around this path, being unable to escape from the bar, concentrate in the upper end which in this way becomes the negative pole of a temporary or electro-magnet.

The lower end of the bar, from which a large number of electrons have been withdrawn, would form the corresponding positive pole. Now, supposing the current, which is causing the concentration of electrons in the upper end of the bar, be suddenly interrupted, the particles in the iron bar will endeavour to restore equilibrium and will, therefore, return to their original positions by the same spiral path which they followed in the course of their upward movement. As every moving electron is a minute magnet, these particles in the iron will attract the electrons in the coil of wire, causing them to move round the spiral in a direction opposite to that which they travelled in the form of an electric current, in the first stage of the experiment. In this way a second current would be set up, or "induced," provided the electrons were free to move in the wire coil; for example, if the two ends of the coil were joined, forming a closed circuit, a temporary current of electricity would flow through this circuit simultaneously with the return of the electrons in the bar to their original position. If a bar of hard steel be substituted for the soft iron in the forego-

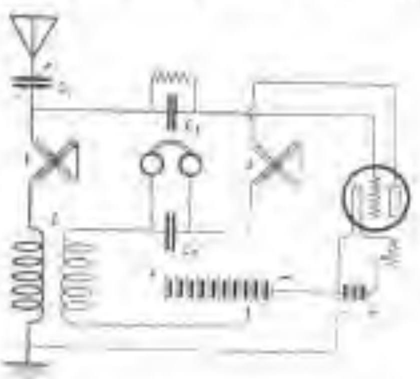
ing experiment, the electrons will not return after the interruption of the electric current, but will remain fixed, concentrated along spiral lines at the negative pole of the magnet: in other words, the bar will become permanently magnetised.

The "Ether" is in some way, intimately associated with the magnetic properties of electrons. When a moving electron is suddenly stopped it acts on the ether as a stone acts upon the surface of a pool of water in which it is dropped, causing "waves" which radiate in all directions. These waves, when produced by the sudden stoppage of a succession of electrons rapidly moving in an exhausted bulb, are of exceedingly short duration and of very "High-frequency;" they are, in fact, what we know as the X-Rays of Rontgen.

Electrons, moving or swinging in regularly defined orbits, produce waves in the ether whose frequency corresponds to the number of electronic rotations in the unit of time. Thus the electrons in the sodium atom, which move around their orbits 500,000,000,000,000 times per second, give off (when in an incandescent state, as in the flame of a Bunsen burner) "Electro-Magnetic Radiations" or waves in the ether of exactly the same frequency, and a wave length of 65 micron.

AN AMATEUR WAVE LENGTH RECEIVER.

ALTHOUGH entitled an amateur wave length receiver, this circuit can be made to bring in 600 metre signals by shorting the condenser in the aerial circuit. The tuning elements are a variable condenser of .001 mfd. capacity, and three home-made variometers. The variometers are wound on cardboard tubes for the stators and rotors (stator stationary,



A Receiver with a Home-made Variometer

rotor, the moving part) the stator tube being 3½ inches in diameter, the rotor tube 3 inches. The stators have 18 turns of No. 22 or No. 24 single cotton covered wire, and the rotors have 22 turns of the same kind and size of wire. The inductance in the aerial circuit is a variometer, although it is not represented by the usual form of drawing. It is drawn in this special manner because the rotor is not connected in series with the stator winding as in an ordinary variometer. The connection is broken in variometer No. 2 to permit of the coupling in of the "B" battery. C2 is a fixed condenser of .0015 mfd. Variometer No. 1 in conjunction with the variable condenser varies the wave length. Variometer No. 3 controls the feedback or regeneration.

There are no taps, all the tuning elements being continuously variable by the variometers and condenser. The variometers cost but a shilling or so, and the set is one of the most efficient that can be constructed by the experimenter.

* * *

AIRPLANE PILOTED BY RADIO.

EXPERIMENTS by French engineers have demonstrated that it is quite feasible to guide airplanes by means of radio waves, without the presence of a pilot in the machine. The first such flight, made without a person on board the airplane, took place on November 25 at Paris. A 300-horse-power Voisin plane took off from the field alone, circled above it for several hours, and then descended. Its every movement was directed by engineers Demarcey, Bouche and Percheron, operating a special radio transmitter located in a hut on the outskirts of the flying field.

* * *

A NEW LOOP AERIAL.

SPEAKING of loop aerials, Doctor J. M. Miller, of the Radio Research Laboratory of the U.S. Navy, has invented a remarkable coil aerial which, for portability and general convenience, puts the ordinary loop aerial in the shade. It consists of a coil only five inches in diameter, which is described as resembling, to a casual observer, an abbreviated induction coil. You simply lay it on the table and go ahead. It is used by the inventor with a special amplifying set. Exact details of the latter are withheld for the present, as it is under consideration for adoption by the navy.

ADDING ONE STEP OF AUDIO-FREQUENCY.

VERY often the owner of a valve receiver would like to use a loud speaker, but may not care to go to the expense of a ready made amplifier. A one-step amplifier may be made up very easily by procuring the parts and mounting them on a piece of thin dry wood. A small bobbin insulator, screwed on at each corner of the wood, will raise it from the

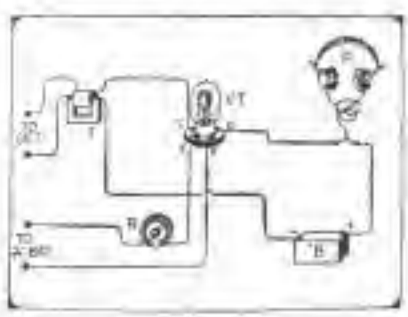


table and allow connections to be made from underneath. The primary of the audio-frequency transformer is coupled to the terminals where the headphones are attached. One of the terminals on the secondary side of the transformer is coupled to the grid of the amplifying valve, and the other terminal to the negative line of the filament.

The same batteries will serve for the two valves.

For the amplifying valve, simply take the highest potential positive tap of the "B" battery to one side of the loud speaker or headphones, and the negative side of the "B" battery connected to either the negative or positive terminal of the "A" battery, according to the circuit, will serve as a common negative for the whole system.

Elementary Magnetism and Electricity

Article 3

Foreword: If Beginners in Wireless will consistently follow this Series of Articles, they will soon grasp the fundamental principles underlying the science.

ELECTRODYNAMICS is that branch of electrical study which deals with the action of one electrical current wire or conductor upon another wire or conductor.

One of the laws relating to electrodynamics is:

Two parallel conductors attract each other when the currents therein flow in the same direction, and repel each other when the currents flow in opposite directions.

This rule is applicable whether the wires are of the same or different circuits, and whether the wires are straight or curved.

Another rule applying to the action of conductors states:

Conductors crossing each other obliquely tend to take up a position in which they are parallel and the currents in them are flowing in opposite directions.

There is no tendency for the wires to be attracted or repulsed lengthwise, the action being entirely sideways.

Electromagnetic induction is the production of electric current in a wire, through the action of a magnetic field.

It was shown, in Article 2, that a wire coiled about a lead pencil with a current flowing through it, would set up a magnetic field in the direction of the pencil.

In 1831, Faraday, of England, demonstrated that the motion of a magnet near a closed circuit produced an electric current in that circuit. Moving the coil and keeping the magnet still produces the same result, the essential element being to cut the magnetic lines of force by the moving of the wire or magnet.

An apparatus producing this effect consists of a bobbin of wire connected to a galvanometer. When a permanent bar magnet is plunged into the centre of the spool there is a deflection of the galvanometer needle, proving that a current has been produced.

As soon as the bar magnet comes to rest at the bottom of the bobbin there is no further deflection of the galvanometer needle, and it returns to its normal position. As soon as the bar is pulled out of the spool, the galvanometer needle swings in the opposite direction, demonstrating that a current has been produced, which flows in the opposite direction to that produced when the bar magnet was plunged into the bobbin.

We learned, in Article 2, that two bobbins of wire placed within each other acted in much the same way.

The small bobbin which was placed inside of the big bobbin, may be termed the "primary," as it contained the electric current that produced the magnetic flux, and which, in turn, produced the current in the second or big bobbin. The big bobbin, which received the induced current, may be termed the secondary. Primary-original currents—secondary—induced currents. By committing this to memory, it will be easy to understand the action that takes place in induction coils and transformers, and how low voltage current in the primary may be raised to a high voltage current in the secondary; or, how a high voltage current in the primary may be lowered to a low voltage current in the secondary.

It has been made clear that electrical currents may be "induced" in a coil of wire by another coil of wire or by a magnet.

The beginner may be puzzled, however, to know how one coil of wire can "induce" in another coil of wire, an electrical current of greater voltage or pressure than the original current. The explanation is that given in Article 1, where it was shown that around a wire carrying an electric current, a magnetic field is formed, and if one looks at the end of a piece of wire, the magnetic field may be imagined to be a circle drawn around the wire with the wire as the centre of the circle. If the current were actually flowing, the circle would be more like looking at a moving screw, end on, the screw revolving towards the eyes when the current was in one direction and away from the eyes if the current were in the reverse direction.

A length of wire, whether straight or coiled, carries this magnetic flux around it when a current is flowing in it. The longer the wire, if it is straight, or the greater magnetic number of turns, if it is coiled, the greater the volume of flux. If therefore the primary wire of one bobbin has a few turns of wire and the secondary wire of another bobbin has a very much greater number of turns of wire, the magnetic flux will be proportionately greater, and the induced current will be so much greater, that is greater in pressure and necessarily less in quantity. More voltage and less amperage.

Why greater voltage and not greater amperage also?

The answer is the same as that given to the individual who asks why perpetual motion is not possible? It is because, to use a homely but very effective illustration, it is impossible to make a sausage machine produce a pound and a half of sausages out of a pound of sausage meat.

If the primary bobbin received a battery current of six volts and two amperes, six, multiplied by two, gives twelve, as the number of "watts" of the exciting current. If the secondary bobbin had sufficient turns of wire to raise the voltage to twenty-four, the amperage would be only one-half of an ampere, as twenty-four multiplied by one-half, equals twelve watts. In practice, the amperage would not be quite so much, as there are certain losses in induction coil and transformer construction, which diminish the wattage output as compared with the wattage of the input.

Remember that the voltage multiplied by the amperage gives the watts of the current, and that this may be produced in the secondary in any form of pressure (voltage), and quantity (amperage), according to the design of the transformer or induction coil, less the losses mentioned.

It was mentioned in Article 2 that there cannot be "induction" without motion. The reader will remember the cases of the moving wire-bound bobbins, one within the other, and that of the bar magnet moving within a wire-wound bobbin. Article 2 also pointed out that the bobbins may be stationary if the electric current "moves," as it does in the kind called "alternating." This current "moves," first, round one way, and next, round the other way; it does not flow along steadily in one direction, as does "direct" current.

Induction coils are excited by direct current, but the wire wound on the two "bobbins" used in the induction coil, does not move, and as there is no "movement" of the current, how is the induction set up?

A simple illustration will provide the answer.

Take a piece of copper wire three feet long and let the middle foot length be kept straight. One foot at either end is bent upwards until each one may be joined to a terminal of a galvanometer.

Take a second piece of copper wire of similar length and bend it like the first piece. One foot, in the centre, will be straight, and one side may be joined to a push switch, the other end to a flashlight battery, and then on to the switch.

Bring the two straight sections of the wires to within an inch or so of each other and press the switch. On this being done, the galvanometer needle will be deflected, and if the finger is kept on the switch, it will soon return to the normal position.

Now take the finger off the switch—the needle will again be deflected, but this time in the opposite direction, showing that a current was induced in the second length of wire, in one direction when the switch was pressed, and in the contrary direction when the current was shut off. Make and break the current in this way, and you supply the necessary "movement" to produce induction, even though the wires are stationary, and the current a steady direct current. If the object of the experiment was to make the galvanometer needle jump about, the more quickly you could press and release the switch the more you could keep the needle "on the jump." The more times per second you could produce the induced current in the second wire, the more effective would be the "jumping needle" work done.

In the induction coil, a steady direct current is made and broken many times a second, and as electricity travels at the rate of 186,000 miles per second, we are not likely to overtake it with the fastest kind of make-and-break device available.

The well-known "shocking coil" has a trembler device which makes and breaks the current about 90 to 100 times per second.

Another kind of make-and-break is the mercury type, in which a little propeller dips in and out of mercury, making contact each time the blade touches the mercury. This type of make-and-break interrupts the current up to 200 times a second. A third form of make-and-break is a chemical arrangement called a Wehnelt interrupter, which makes and breaks the current 2000 times a second. The mercury type is most popular as it is efficient and practically noiseless.

It will be plain that the more inductive "impulses" per second the secondary winding receives, the more efficiently will it perform the work required of it.

The simplest kind of wireless transmitter is an induction or "spark" coil, and in this device two small rods are inserted in the secondary coil terminals and brought near enough to each other for a spark to jump across. One secondary terminal is connected to the aerial, and the other one to an earth connection. A sending key is placed in the battery circuit and as this is pressed down a long spark or a short one crosses the air gap between the ends of the two rods mentioned, corresponding to the dot and dash of the Morse code.

For wireless purposes, induction coils are constructed to deliver a short "fat" spark, whilst those intended for X-Ray or other medical purposes give a long thin spark. In the first case the secondary is arranged to produce an induced current of comparatively low voltage with correspondingly large amperage. The medical coils give a relatively high voltage with a low amperage ratio.

Bearing in mind the sausage meat illustration it will be seen that one kind of induction coil would not serve both purposes.

A short, heavy spark means plenty of current at a comparatively low voltage. The long thin spark required for X-Ray purposes necessitates very high voltages, as the greater the air-space to be jumped by the spark, the greater the voltage needed. To jump one inch of air-space, 25,000 volts are required, and to jump 16 inches of air-space 100,000 volts are required.

It is not difficult to construct induction coils producing these high voltages in the secondary, it being quite a common thing to see ten inch spark coils, requiring 110,000 volts on the secondary terminals, to jump the ten-inch air gap, the ordinary 6 volt accumulator supplying the current for the primary coil. This marvellous increase in voltage is brought about by suitable arrangement of the ratio of the number of turns of wire in the secondary coil to those in the primary coil. High voltage transformers are similarly arranged.

In designing induction coils, it was found that if a magnet is placed within the primary coil, the induction of current in the secondary coil is intensified. In other words, the beneficial properties demonstrated by the bar magnet experiment are combined with those of the two wired bobbin experiment in the construction of induction coils and transformers.

In both induction coils and transformers, permanent magnets are not used, but soft iron cores, which become electro magnets when the current is made or broken, are preferred. For one thing, permanent magnets would maintain a current in the coils, when it was desirable, in order to obtain maximum efficiency, to effectually and positively make or break the current, to secure the best make and break effect.

The iron core in the induction coil is a bundle of soft iron wires, boiled in wax and carefully covered with insulating tape, to ensure that there will be no short-circuit with the primary winding.

In the transformer, the core takes the shape of thin slats of soft iron laid one upon the other, until the required thickness is made up.

The writer has, on occasion, used an eighteen-inch induction coil on alternating current, as what is called an "open-core" transformer. Recalling the wire wound on a lead pencil, mentioned in article 2, the magnetic flux of the core of this induction coil would be along the axis of the primary coil, at the ends of which it would spread out, up and down, meeting in mid-air, top and beneath the coil, in fact in every direction. This entails considerable loss and is very inefficient for transformer purposes.

Transformers have what are known as "closed" cores. The iron slats are laid in a rectangular form, long slats for the sides, and short slats for the ends. In this case, the magnetic flux is confined to the iron, and travels round the iron instead of part of the path being through air as in the case of the induction coil. In the closed iron core, there are no losses due to air resistance.

As it is impossible to apply any form of make-and-break to a closed core, a transformer can only be operated on alternating current, where the current itself provides the "movement" which, as has been pointed out, is always necessary to produce an induced current.

The make-and-break device of the induction coil acts by permitting the direct current to flow through the primary coil, which then makes a magnet of the iron core. Attached to the "trembler" of the make-and-break device, is a knob of iron, which is attracted by the iron core magnet. As soon as this takes place, the current is broken, the iron core ceases to be a magnet, and the iron knob or hammer is released, and because the "trembler" is a piece of strong flat spring steel, it jumps back into normal position, bringing the electrical contacts together once more, when the operation is repeated, and so on.

Up to this point we have considered how currents of high potential may be produced. The currents used in wireless are those having both high potential and high frequency.

Relatively speaking, there is nothing particularly remarkable about currents of high potential, except, perhaps, that they are extremely dangerous to life, and that alternating currents of high potential may be transmitted over a great distance on comparatively thin cables, to be converted into currents of low potential by transformers, and carried by thick, heavy cables to the places where the electric service is required.

The beginner often wonders why the two kinds of electric current are employed.

Direct current cannot be generated at high voltages, as at the 600 volts point sparks begin to fly across the commutator brushes of the generator.

As alternating current generators have neither brushes nor commutator, this trouble is not experienced, and very high voltages may be produced by this type of generator.

To transmit direct current over long distances, very heavy cable, and correspondingly heavy carrying standards would have to be provided. In addition, direct current rapidly drops in voltage when transmitted over long distances. Light cable and light carrying standards may be used with alternating currents as transformers may be employed to convert high voltage and low amperage (quantity) into low voltage, heavy amperage currents.

(To be Continued)

New Apparatus and Appliances

THE ARMSTRONG SUPER-FILTER CIRCUIT.

THE keen experimenters with the Armstrong Super-Regenerative Circuit will be pleased to learn that the parts completing the filter circuit are now available. The James Chambers and Co. Pty., Ltd., of 374 Little Collins Street, Melbourne, have just landed a shipment of Kellogg goods, including the above parts. The 15000 ohm non-inductive resistances, and the 1 Henry choke may be obtained at the address above, or in the Sydney district from The Burgin Electric Co., 352 Kent Street, Sydney, N.S.W.

It will be remembered that the Kellogg people were early in the field in the matter of supplying the filter circuit elements to the many thousands of American experimenters who have successfully constructed Armstrong Super-Regenerative Sets. A good deal of their success has been due to the Kellogg firm, which has spared no pains to render the filter parts thoroughly efficient.

THE KELLOGG HEADSET.

THE Kellogg Standard Headset, No. 89, has an exceptional degree of efficiency, and is very light and small in size. It is so scientifically designed that it never needs adjustment.

The shell is a non-metallic one, being constructed of bakelite, and all the terminals are entirely enclosed within it. The concave surface of the cap is in accordance with the most modern telephone engineering practice. It screws into place with short threads, which will not allow it to slip. The general design of the Kellogg Headset is such that if it is desired to use an earpiece for each of two persons, the headband is removed in an instant, and is as easily replaced.

The magnet is the heart of a radio headset, and in this one the special tested steel employed is hardened by a unique process which is governed by automatic machinery, thus ensuring the absolute uniformity and quality. The windings and assembly are carried out with all that care which has made the name Kellogg the hallmark of high-grade radio apparatus. The total resistance is 2400 ohms, and the headband is of light construction and is covered with a khaki coloured material. The Burgin Electric Co., of 352 Kent Street, Sydney, are the representatives in New South Wales for Kellogg Radio and Telephone products.

* * *

A NEW VICTORIAN AGENT.

THE Western Electric Company advise us that their agent in Victoria is now Mr. C. R. Foster, 588 Bourke Street, Melbourne, which Victorians might kindly note.

Remember our Big Subscription Drive and get ONE Subscriber

RADIO GOODS MANUFACTURERS.

MESSRS. Ramsay, Sharp and Co., Ltd., of 217 George Street, Sydney, are manufacturing all kinds of radio goods from rheostats to complete valve sets. A very neat little crystal set this firm turns out sells at £2. We examined a line of variometers with positive contacts for the rotor, brought out through the hollow bearings, and priced at 25/-. A line of vario-couplers, ranging up to 750 metres, and with the same positive rotor leads, costs 30/-. The variable condensers are a fine, businesslike looking line, splendidly mounted, and with 3 to 67 plates, according to the capacity required.

A new catalogue is being prepared, and by the time these lines are in print, it will be available to those fans who will write for it. A speciality is being made of making up sets to the customer's plans and specifications, or a suitable set will be recommended and built for a customer who wants to get the best results in his locality.

THE FRAZER MAGNETIC RECTIFIER.

THE Frazer Full Wave Magnetic Rectifier is an Australian production, manufactured at the Science Research Laboratories at Woollahra. It is robustly constructed, and is a means whereby the radio fan may settle his battery charging troubles. It is connected with the 240 volt a.c. mains

and transforms and rectifies that current to 6 or 12 volts. It functions as an automatic circuit breaker, and if the mains supply fails, it cuts out the battery, thus preventing it discharging back. On resumption of the mains supply it cuts itself in again, and the charging is continued. Its efficiency is 100 per cent. as it utilises both sides of the wave. The Frazer Rectifier comes complete with calibrated ammeter, connecting cords, and battery connecting clips.

It may be purchased at the Universal Electric Company, 244 Pitt Street, Sydney, N.S.W.

* * *

A HANDSOME RECEIVER.

NSW System Wireless, of 280 Castlereagh Street, Sydney, N.S.W., and 71 Market Street, Melbourne, Vic., have shortly to arrive a large shipment of the high-grade receivers and amplifiers manufactured at their works in England. By the time this appears in print it is expected that the goods will be on hand.

Specimen sets already to hand and inspected by us, go to prove that this firm's radio sets are splendid examples of the honest and skilful British workmanship, for which the Old Country is famous the world over.

The set illustrated is equipped with three valves and a loud speaker is built into the base, a very convenient way of providing for this usually cumbersome and more or less unsightly addition to a radio set. A switch of the pull-push type controls the volume of sound from the loud speaker, and a similar switch provides for short or long wave reception.

The case is a fine specimen of the cabinet-maker's art, and is highly polished. It is the type of receiver which

will find favor in my lady's drawing room, when broadcasted concert affords her the opportunity of entertaining her friends with wireless music at afternoon tea.

COTO COIL PRODUCTS.

THE Coto Coil Co. are in the front rank of American manufacturers of super radio apparatus, and are represented in Australia by Messrs. L. P. R. Bean and Co., Ltd., of 229 Castlereagh

Street, Sydney, N.S.W. Coto coils are of the honeycomb type and the special winding renders them highly efficient. They may be had mounted or unmounted, and mounting brackets are supplied with right and left hand long handles. The Coto Condenser will catch the eye of the discerning experimenter. It is beautifully built, like a watch, at the spring pins, so it is impossible for it to get out of adjustment. The Coto Radio Frequency Amplifying Transformer has been designed to embrace all the advantages and good results of resistance coupling, iron and air core transformers, without any of the disabilities which are inherent in each, and two or three transformers are coupled in series, if as many stages of radio frequency amplification are employed. They are suitable for different wave lengths.

* * *

THE "TUNIT."

THE "Tunit" is a neat little invention recently placed upon the radio goods market by the Ship Owners Radio Service Inc. of 80 Washington Street, New York City, U.S.A. It is designed for use with a honeycomb coil panel in replacing the honeycomb coils for short wave reception. The three pins at the upper part of the illustration are the pins to plug into the standard honeycomb coil holder, and underneath each pin is the usual thimble which the pins on the holder fit into. It is claimed that this device is much more efficient for short wave work, and as it is readily removed from the coil holder the ordinary coils can

be used for long wave reception. Its wave length is from 150 to 600 metres and has shielded dials, perfectly balanced, making the closest kind of tuning possible. The dealer who imports a few on trial should find a ready sale for the "Tunit."

NEW LAKE STEAMER INSTALLATION.

THE Radio Corporation of America has just installed a new radio telegraph and telephone transmitter on the "City of Detroit III," which sails on the Great Lakes between Buffalo and Detroit.

REAL COMFORT

HAPPENING to drop into the electrical supplies establishment of Messrs. W. G. Watson and Co., Ltd., 279 Clarence Street, Sydney, on a cold, wet and bleak day recently, we were tempted to paraphrase Omar Khayyam by saying, "A well filled pipe, a concert receiver, and 'thou'"! "Thou" was the finest thing we had seen in electric fires for many a day. Finished in dark-green vitreous enamel, and of a size sufficient to cover up a coal-fire grate, it was truly a "thing of beauty and a joy forever." It was an electric fire, known as the "Belling," and for

which Messrs. Watson and Co. are the agents. This particular electric grate was intended for a dining room and on the front of it was a very useful attachment intended to keep food warm during the meal hour. It threw out a most pleasing heat, and we were surprised to learn that it was only consuming 1 unit per hour. If full heat is required, as much as 3 units per hour current can be switched in, but for an ordinary room, the 1 unit would be all sufficient. Even at three units per hour, the cost would be only 4½d., whilst at one unit consumption, it would cost but 1½d. per hour to run.

Who would be troubled with coal or odorous gas fires under such conditions?

Don't Forget — One Subscriber for One Reader will double Review circulation and enable us to increase the number of Review pages

ELECTRICAL SECTION.

All the Comfort of an Electrical Home

A FRIEND of ours, just back from a tour through the United States, is much impressed with what he saw regarding the universal use of electrical devices in the home.

Amongst other places, he visited a friend whose residence was in a large block of flats in Los Angeles. Arrived at the front entrance of the building, he found that he was barred from entering the inner hallway by a double glass door, which was apparently firmly locked. On the right hand side of the outer entrance hall was a sort of switchboard carrying a number of small telephones, and underneath each one was a tenant's name with the word "press" over a small push button. He pressed the

The Home Refrigerator

button underneath his friend's name, took off the telephone receiver, and waited a moment. "Hello," came over the 'phone.

"Is that Mr. ————?" followed. "Yes; that you, Jim; come right up; take the automatic elevator and press 6," was the reply. Before our friend could say anything further, a click in the 'phone announced that the receiver upstairs had been hung up, and the question as to how to get in was instantly answered in a startling manner. The big glass doors slowly opened, and after remaining open for a few seconds, slowly closed in the same mysterious way.

Arrived at the sixth floor, the mystery was soon explained.

Every tenant had his house telephone, and when a visitor announced himself (or herself), the flat renter pressed a button, which set into operation electric mechanism that opened and closed the main doors, allowing plenty of time for a person to pass through.

More surprises were in store. In the sitting-room two large and handsome porcelain pedestals threw the soft illumination of indirect lighting into every corner of the room. In a recess a beautiful polished gunmetal fitting provided the means of connecting up an electric gramophone, and on the other side of the room was a similar fitting to supply current for an electrically-driven player piano.

Passing on to the bath-room, there were separate shower bath and the usual plunge bath, both in white porcelain, and each furnished with its own electric water heater. A white porcelain pedestal hand-basin was placed in front of a mirror of generous size, and on each side of which was a small electric light, at just the height suitable for shaving purposes. The shaving water was provided by an immersion heater, plugged into the same type of handsome fitting as installed in the sitting room.

In the laundry, were an electric washing machine, which boiled the clothes as well as washed them, an electrically driven and heated mangle, permitting hot or cold mangling to be done, a rugged electric radiator for the wintry weather, and the usual electric hand iron and fittings.

No ice was needed in the summer time, as an electric refrigerator, built in the pantry, kept the foodstuffs at any temperature desired. In one corner of this room was a motor driven vacuum cleaner, provided with the necessary attachments to clean the walls and to dust the backs of pictures and to give the carpets a periodical cleansing.

A fitting was provided in every room to permit the vacuum cleaner to be plugged in.

In the dining-room were an electric kettle, a toaster, a coffee percolator and a radiator.

In the bedrooms, artistic fittings allowed the use of electric radiators, bed warming devices, and water heating attachments, to obviate the necessity to leave the room, when, through sickness or any other cause, hot water was required during the night.

In the kitchen everything was furnished that could reduce the expenditure of labour to the absolute minimum.

Our friend expressed the opinion that all these electrical conveniences must have cost a great deal of money. To his intense surprise, he was informed that they had cost the tenant nothing, and that they were all provided by the owners of the flats.

All that is perhaps a bit too elaborate for Australia at the present juncture, although there is no reason that it should be.

It is certain that we shall arrive at such a stage of development in due time, and if we are not pre-

pared to go so far in the matter of saving labour in the home, there is no good reason why we should not lighten the domestic drudgery by equipping the kitchen with every electrical device obtainable.

The electric kitchen shown in the illustration includes an electric water heater, fans, egg and cake beaters, electric toasters and the latest pattern electric cooking stove.

Regarding electric cooking, any housewife who has had experience of electric cooking knows that nothing else compares with it economically, efficiently, or conveniently. There are no objectionable fumes, no dissipated heat to render the kitchen unbearably hot; the regulation is so scientific that everything is cooked just to the correct point, and it costs less.

For small families there is an electric cooking stove known as the Lamp Socket Oven. This electric cooker will roast a chicken, bake two loaves or two pies, and has three heat controls, low, medium and high, all controlled by a snap switch. The photo of this stove will convey an idea of its compact and neat appearance. It is the type of electric oven which will solve the problem of flat dwellers, to whom, in their restricted quarters, the fumes of gas cooking apparatus is very objectionable.

Everybody appreciates the fact that electric lighting is not only more cleanly and convenient than gas or any other form of lighting, but that it considerably cheaper. Comparatively few, however, have taken the trouble to enquire into the relative cost of electric and gas cooking. If they did so, they would find that in addition to the gain in cleanliness and convenience, electric cooking is really cheaper than with any other kind of cooker.

Winter will be here shortly, and in the case of those who do not have the enjoyment of the most robust health, the warming of icy cold sheets on the bed is a problem solved for the most part by the old-fashioned and clumsy hot water bottle. This antiquated piece of household apparatus involves the trouble of boiling water and filling the indiarubber or stone bottle with it. Very often a faulty cork or stopper results in the saturation of the bed clothes. There is also the danger of the housewife being badly scalded when filling the hot-water bottle. For a very few shillings more than it costs for the indiarubber type of water-bottle, an electric heating pad may be obtained. In sickness this pad can be used for the application of wet or dry heat, and with dry heat it can be used in the winter time for airing the cold sheets before retiring.

In connection with the general heating of the home in the winter season, the coal or wood fire is very objectionable, entailing, as it does, the daily cleaning out of ashes that find their way in dust form to every article of furniture in the room. The gas fire is more cleanly, but the fumes of a gas fire are not the most pleasant things in the world, and from time to time a gas fire requires a thorough cleaning to keep it up to full efficiency. With an electric radiator there is no dust, no smell, and it requires no attention whatever. Just snap on the switch when heat is required, and in a few moments a pleasant heat suffuses the room.

Electricity in the home means labor saving, comfort, convenience, and economy, so why plod along with old-fashioned methods when the magic fluid will do so much to relieve the drudgery of housekeeping?

THE SERVANT'S NAME IS "ELECTRICITY"

Is your home equipped with the conveniences and refinements this wonderful Electrical Science has placed at your disposal?

The First Armstrong Super to work in Sydney

HERE is a photograph of the first Armstrong Super-Regenerative Receiver to work successfully in Sydney. It was made by Mr. Fry, of the Universal Electric Co., of 244 Pitt Street, Sydney, N.S.W.

On the right of the photo, the two D.L. coils of 1500 and 1250 turns are housed in the round, box-like construction. The coils are thus inductively coupled and are placed at the distance apart which has been found correct by experiment. The first condenser is one built by the firm, and is of .001 mfd. capacity. This condenser is in the regenerative circuit, and is shunted across the primary of the vario-coupler, and the loop. The condenser in the oscillatory circuit is one of .0005 mfd. All three valves have a 4.5 volts flash light battery in series with the grids, negatives to the grids, the positives to the "A" battery negative lead. Two of the valves are Cunningham Amplifiers, No. 301, and the third valve, the amplifying valve, is a 5 watt Cunningham.

A "Master" audio-frequency transformer is used in conjunction with the amplifying valve. Each valve is furnished with a separate vernier rheostat. The diagram includes the two 12,000 ohm, non-inductively wound resistances and the 100 millihenries iron core choke. Both the resistances and the choke were made by the company. The large coils are of the Burndept type.

[illegible]

The variocoupler is a beautifully moulded one, and its range is up to 450 metres. The control of the receiver has been considerably simplified, but it is still critical, seemingly an inevitable feature of the Armstrong Super Circuit.

Several demonstrations have been given at the North Sydney Club by Mr. Raymond McIntosh, and the members have expressed their delight at the performance put up by the receiver, both with the loop and the outside aerial.

Anyone desiring to obtain the necessary parts to make up the Armstrong Super will receive full information as to parts required and cost of same by writing to the Universal Electric Co., whose address is given above.

Answers to Correspondents

[illegible]

[illegible]

[illegible]

Our Monthly Photographic Competition

Very many Wireless Experimenters are also photographic enthusiasts; others have amateur photographer friends who will co-operate with them in sending in exhibits for the monthly competitions of

"The Australasian Wireless Review"

Every month we offer a prize of ONE GUINEA for the best photo of an amateur wireless set in any part of Australasia. TEN SHILLINGS AND SIXPENCE will be paid for the SECOND BEST, and FIVE SHILLINGS for the THIRD. A SPECIAL PRIZE OF TEN SHILLINGS AND SIXPENCE will be awarded for the best radio novelty photograph.
The prizes to be awarded for the best Wireless Sets may be won by those possessing any kind of Set, Crystal or Valve; efficiency, neatness of workmanship and quality of photograph, being the leading factors to be taken into account.

The PRIZE of 10/6 for the NOVELTY PHOTOGRAPH will be awarded for the best photograph of any novel picture or scene in which a radio receiving apparatus is used. Pretty garden party scenes, children listening in, animals hearing radio concerts, &c., suggest themselves as amongst the suitable subjects.
A full description of the competing set to be forwarded, together with wiring diagram of same if possible.

Full names of people, and full description of the photo appearing in novelty photos section is desirable.

All photographs to be the property of the Proprietors of The Australasian Wireless Review. The Editor's decision to be final.

Photos may be sent in at any time, and all the photos to hand by the first of each month will be included in the following month's REVIEW COMPETITION.

Here is the opportunity to win a guinea, half a guinea, five shillings, or the special prize of half a guinea, and at the same time to let your fellow experimenters know what you are doing in your section of Australasia.

Send your photo in To-day! *Do not Delay!*

LIKE A MAGNET!

N.S.T. Crystal Set, with Patent "Everest" Crystal Detector and either 2000, 4000 or 8000 ohms Headphones.

New System Radio Sets

Draw Speech and Music from the Air

The N.S.T. No. 2 Radio Crystal Set is now being used with great success by Amateurs in England, where it has been approved by the broadcasting authorities. It was designed by our own wireless experts, and is manufactured at our London works.

Approved by the British Postmaster-General for Broadcasting

N.S.T. Crystal Radio Set, No. 2

THIS Set is handsomely finished, and is made up of the best materials. Suitable for any wave length up to 650 metres. It is fitted with our "Everest" Patent Automatic Crystal Detector, which needs no adjustment whatever, and is always in position.

The whole mounted in polished Walnut Case. Size, 5½in. x 5in. x 5½in. Complete with 2000, 4000 or 8000 ohms Headphones. **Price, £7.**

N.S.T. Headphones. **Price, £2 5/- Set.**

Postage Extra.

IMMEDIATE DELIVERY.

"New System Distortionless" Audio-Frequency Intervalve Transformer.

A "shell" type transformer designed and built on scientific lines for simplicity, strength and compactness without sacrificing efficiency.

Special attention has been given to winding and insulation, every individual turn being specially insulated from adjacent turns as well as between layers.

Construction is on exactly similar lines to power transformers. The closed core is built up from best quality stalloy iron laminae.

Its losses have been reduced to a minimum, and the characteristics are such as to give maximum amplification without distortion or "howling."

Every detail to promote the efficiency of our instruments has been carefully executed.

Dimensions are reduced to the smallest limit consistent with absolute reliability.

These advantages are invaluable for the successful reception of wireless telephony.

Comparative tests confirm the superiority of our design.

PRICE ... 42/6

"NEW SYSTEM DISTORTIONLESS" AUDIO FREQUENCY INTERVALVE TRANSFORMER (Actual Size).

GUARANTEE

New System Apparatus is guaranteed to be of high class construction as to materials and workmanship. We will replace or refund cost of any that are found to be defective in workmanship or materials, if returned to us within 10 days from date of purchase.

Call, write or 'phone us, and we will at once furnish you with detailed information concerning these transformers.

New System Telephones Pty. Ltd.

280 Castlereagh Street, SYDNEY, N.S.W. Tel. City 8556

54 Market Street, MELBOURNE. Tel. Cent. 11130

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